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The Geographical Journal.

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THE "MICHAEL SARS" NORTH ATLANTIC DEEP-SEA EXPEDITION, 1910.*

By JOHAN HJORT.

In August, 1909, Sir John Murray wrote to me offering to defray the expenses of an expedition to the North Atlantic with the Norwegian research steamer, *Michael Sars*. Since the year 1900, I and my assistants had undertaken cruises with this vessel in the Norwegian sea. We had endeavoured to investigate the distribution of the ocean currents, as well as their movements and fluctuations, and we had also made a number of observations regarding the life-history of fishes and other organisms. We had often had reason to notice the influence which the Atlantic ocean exerts upon more northerly waters. We had seen how the varying volume of Atlantic water streaming over into the Norwegian sea and North sea may affect and qualify hydrographical conditions in those seas; and we had succeeded in establishing the fact that there is a great annual immigration of Atlantic organisms into North European coastal waters.

Only once had I had the opportunity previously of paying a short visit to the Atlantic ocean, on which occasion we succeeded in taking with the trawl, in a single haul at 500 fathoms, a number of fishes that included no fewer than 100 individuals belonging to new species. Since then I had often wished to explore the waters of the Atlantic, so that Sir John Murray's liberal offer came to me as a welcome surprise.

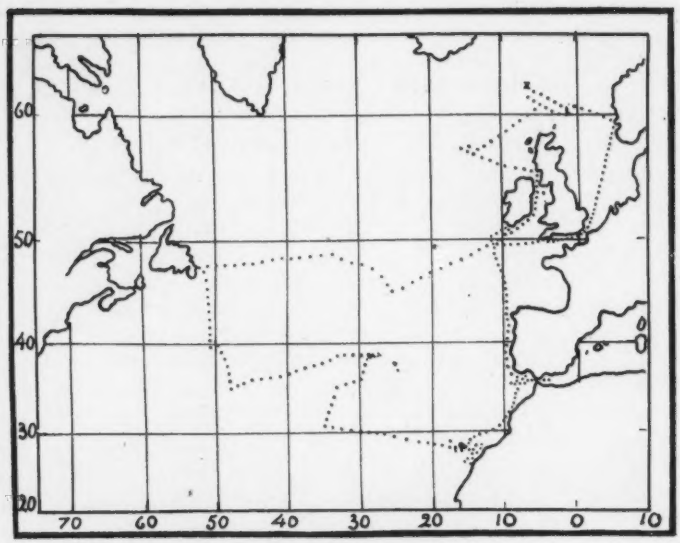
The Norwegian Government showed itself very indulgent towards our enterprise, and placed the vessel entirely at our disposition; and my colleagues, who have so long taken part in these researches, Professor H. H. Gran, Dr. Helland-Hansen, Mr. E. Koefoed, and Captain Thor Iversen, all signified their utmost willingness to join the expedition.

On completing our preparations we started off from Plymouth in the beginning of April, 1910, after being joined by Sir John Murray at that

* Royal Geographical Society, January 16, 1911.

port. We first experimented with the trawl, and undertook hydrographical investigations to the west of Ireland, over the slope of the coast banks. Our course was then set across the Bay of Biscay, where we made a number of investigations, towards the north-west corner of Spain. From there we followed the Spanish and Portuguese coasts down to Gibraltar. Here we obtained a series of current measurements in the strait. Cadiz Bay was next examined; and careful hydrographical observations of the state of the currents were made over several sections of these interesting waters, while a series of trawlings were at the same time undertaken from the coast down to profound depths.

We then steamed in the direction of the Canary islands, and examined



Track of the "Michael Sars"

the African banks from the coast to the ocean floor; and subsequently commenced a large section of the Atlantic, visiting the Azores, the Sargasso sea, and eventually Newfoundland. Throughout the whole of this section, comprising 40 stations, we made constant hydrographical investigations and employed many different kinds of instruments for collecting plankton organisms of all sizes. A similar section was undertaken in July from Newfoundland over to Ireland (22 stations), and we concluded our researches by a more searching examination of the waters between Glasgow, Rockall, the Faroes and Shetland—that is to say, the sea to the south and north of the Wyville Thomson ridge—to study the transition from the Atlantic to the Norwegian sea.

During the four months that the cruise lasted a great deal was accomplished. For oceanographic science it cannot but be interesting to learn that a little steamer, of only 226 tons, could carry out so many and such multifarious researches right across one of the mighty oceans; and I will accordingly give a few figures to illustrate what was done.

In the case of *hydrographical* material we collected 2400 water-samples, more than 900 of which were from below the surface. At 110 stations we took 937 temperature-observations from below the surface, while as many as 1625 observations of the surface temperature were recorded during the cruise. In addition, we obtained 258 measurements of currents and seven measurements of the penetration of light beneath the surface. For the study of *vegetable plankton* we made 140 vertical hauls, and took 38 water-samples for filtering and 58 samples for examining with the centrifuge. For the *larger plankton* there were 95 vertical hauls with nets of different sizes, 193 horizontal hauls with silk nets, 80 horizontal hauls with pelagic trawls, and 18 hauls with a very large tow-net. *Trawlings* were undertaken on twenty-four occasions at different depths.

Our being able to carry out so many investigations, in spite of the fact that the ship traversed a distance of about 11,000 miles during the four months the cruise lasted, shows that oceanographic expeditions can be undertaken in small craft, and for a relatively moderate expenditure. And this will most likely be a matter for consideration when future expeditions are planned.

We returned from our cruise on August 15. In the five months that have since elapsed we have studied as much as we were able of the large amount of material collected. Dr. Helland-Hansen has taken charge of the hydrographical material and Professor Gran of the Phytoplankton, while I have myself organized the treatment of the zoological material. But it is quite evident that we have not yet succeeded in examining more than a mere fraction of the whole.

So, then, while anxious to comply with the request of the Royal Geographical Society, and to describe the results of our expedition, I feel that I am unable to do more to-day than to give a *few instances* of the experiences yielded by our mode of working, and to explain the ideas which have inspired our labours. My aim will be especially to point out those problems for future solution that have arisen during the course of our work. How rich a field for future research there is in the North Atlantic was what chiefly impressed both myself and my colleagues, and it is my hope that the contributions to our knowledge of that ocean which I am now, with their assistance, in a position to put before you, will help to stimulate interest in future researches there.

Hydrographical Investigations.

At 110 stations we collected material for determining *the temperature and salinity of the sea-water*. The temperature observations have now been

corrected, the water-samples have been titrated, and the results are set down in vertical sections and charts showing the distribution of temperature and salinity at the different depths. I shall now give you a few instances of these results.*

Fig. 1 shows the vertical distribution of temperature and salinity in the sea between Newfoundland and Ireland in the month of July, 1910. Throughout nearly the whole section there is a layer with salinities of 35·5 per thousand in the uppermost 150–200 metres. Both salinities and temperatures decrease in fairly regular proportion as we descend, until we reach a uniform layer termed "bottom water," in which the temperature is slightly under 2·5° C., and the salinity is about 34·9 per thousand. It is noteworthy that this salinity is exactly the same as has been found in the bottom water of the Norwegian sea during the previous investigations. During the cruise of the *Michael Sars* in the Atlantic, this same salinity has been discovered both between the Canary islands and the Azores, and between the Azores and Newfoundland, and also outside the Bay of Biscay.

This uniform bottom water lies deeper in the eastern portion of the North Atlantic, off the south coast of Europe and the north coast of Africa, than in the western or north-western portion of the coast of America. East of Newfoundland it attains a comparatively high level, as will appear from the chart in Fig. 2, which shows the conditions at a depth of 500 fathoms. This would seem to indicate that the bottom water of the North Atlantic comes from the north-western portion of that ocean.

The chart shows clearly the influence of the Mediterranean, which has at first been studied by Dr. J. Y. Buchanan, and lately by Dr. N. J. Nielsen of the Danish Ocean Research. Very salt and comparatively warm water streams out of the Mediterranean and sinks through the deeper layers; outside Spain it mainly flows northwards, owing to the effect of the Earth's rotation; another portion seems to follow the ordinary stream towards the west and south-west. Between the comparatively fresh cold water in the north-west and the relatively warm salt water outside Spain a belt extends from west of the Azores as far as the Faroes and Iceland—with fairly uniform salinities of 35–35·5 per thousand, and temperatures of 6–8° C.

In Fig. 1 we see at stations 81 and 82 a comparatively large mass of the salt warm water. It is considerably thinner further east at station 85.

* The temperatures have been mainly recorded by means of Richter's reversing thermometer. In 517 cases we used the same two thermometers side by side. The difference between the corrected values of these two thermometers was on an average about 0·01° C. Mr. Helland-Hansen is of opinion that the accuracy of the temperature-determinations can be set at a few hundredths of a degree. The water-samples were for the most part collected with Ekman's reversing water-bottle. Salinities were determined by chlorine titrations. All the samples were titrated twice, and the salinities are considered to be correct to about 0·01 per thousand. The observations were mostly taken at the surface and at the following depths: 25, 50, 75, 100, 150, 200, 250, 300, 350, 400, 500, 600, 800, and 1000 fathoms. There are comparatively few observations from greater depths.

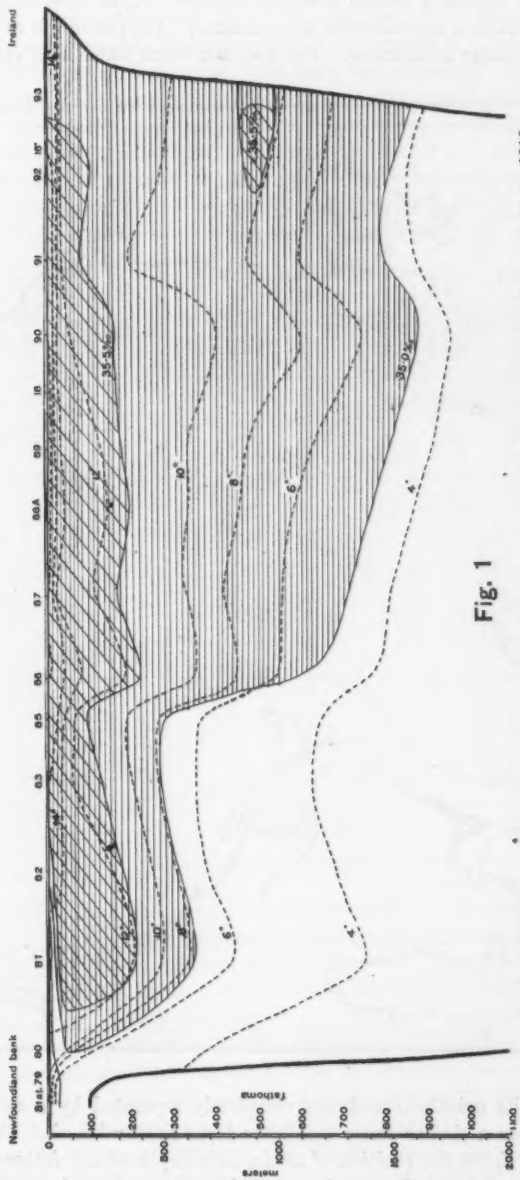


Fig. 1

VERTICAL DISTRIBUTION OF TEMPERATURE AND SALINITY BETWEEN NEWFOUNDLAND AND IRELAND, JULY, 1910.

Fig. 3 depicts a section from the Sargasso sea to Newfoundland. It shows a division which is even more marked. The conditions at station 66 are exceedingly remarkable. The very salt warm water from the Sargasso

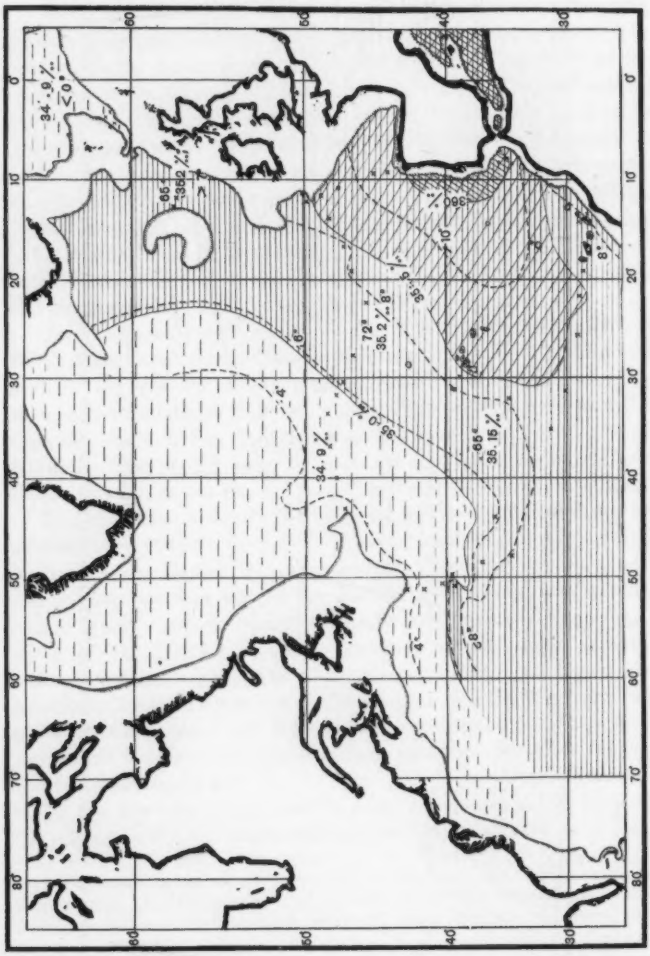


Fig. 2
CONDITIONS AT 500 ENGL. FATHOMS.

sea and its neighbourhood was completely separated by a sort of cold wedge from a similar warm salt-water layer nearer America. The chart in Fig. 4 shows the position of affairs at a depth of 200 fathoms. It is, however, very doubtful whether there is really such a big sunderance in

the stream as the curves would appear to indicate. Only further and more thorough investigations can settle this question, which is important for properly understanding the whole system of currents in these waters. If the chart is correct there must have been also a counter stream flowing towards the south-west, which sundered the water masses moving towards the north-east. A larger number of observations would perhaps have shown that the curves should be drawn otherwise, or this may only have been the state of affairs at the time the investigations were made.

If we compare our temperatures with those of the *Challenger*, we find that *they agree most satisfactorily, as far as the deep layers are concerned*, and

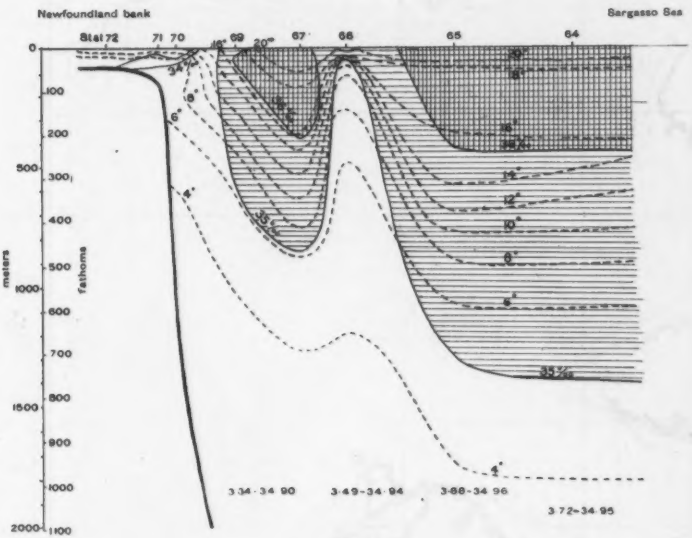


Fig. 3

SARGASSO SEA TO NEWFOUNDLAND.

the temperature observations of the *Challenger* seem to have been very good. In Fig. 5 we have a comparison between the distribution of temperature at the *Challenger* station 354, in May, 1876, and the *Michael Sars'* station 51, in June, 1910. There are some small points of disagreement, but the average curves (dotted) of the *Challenger* coincide pretty well with those of the *Michael Sars*. Fig. 6 shows a similar comparison between the *Challenger's* station 65, in June, 1873, and the *Michael Sars'* station 65, in June, 1910. Here the differences are astonishingly great, even exceeding 3° C. at the same depth in the mid water-layers. This cannot be ascribed to an error of method. In the first place the temperatures at the greatest depth accord satisfactorily in the two sets of investigations,

and further the stations are located in an area where there are not known to be any rapid changes.

If we look at all the stations from the cruise of the *Challenger* in the

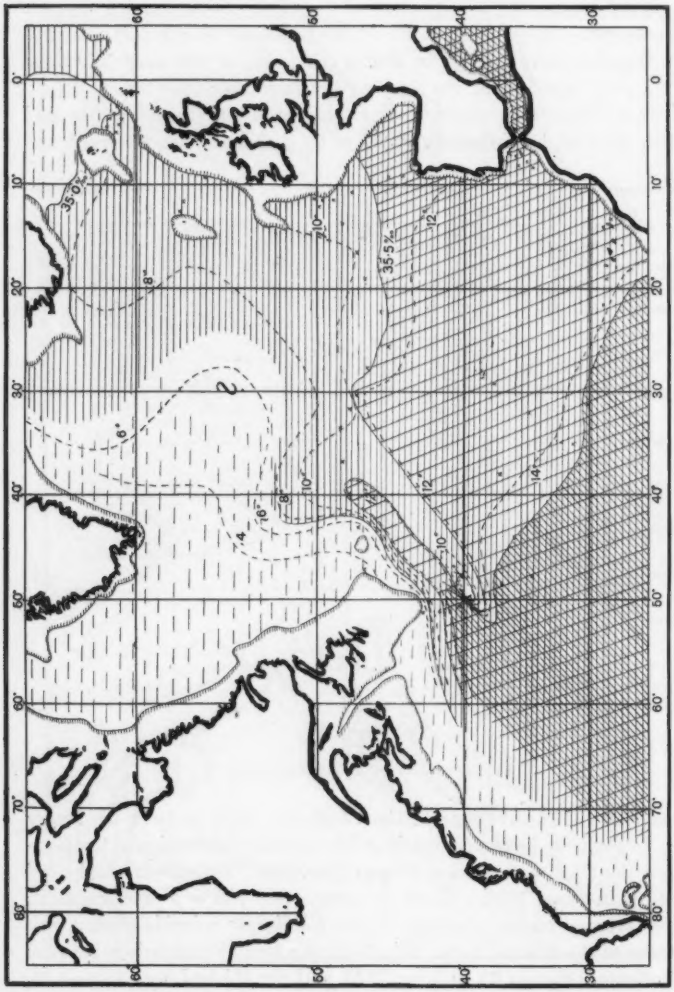


Fig. 4

CONDITIONS AT 200 ENGL. FATHOMS.

summer of 1873, which are situated in the neighbourhood of the *Michael Sars'* stations of a summer thirty-seven years later, we will find everywhere that the water in the mid layers was much warmer in 1873 than in 1910.

The table on p. 358 shows the difference in temperature (in ° C.) between one of the *Challenger's* and one of the *Michael Sars'* stations. The differences go up to about 5° in the mid water-layers, but sink to 0°·1 and 0°·4 respectively in deep water. This seems to indicate that there are such

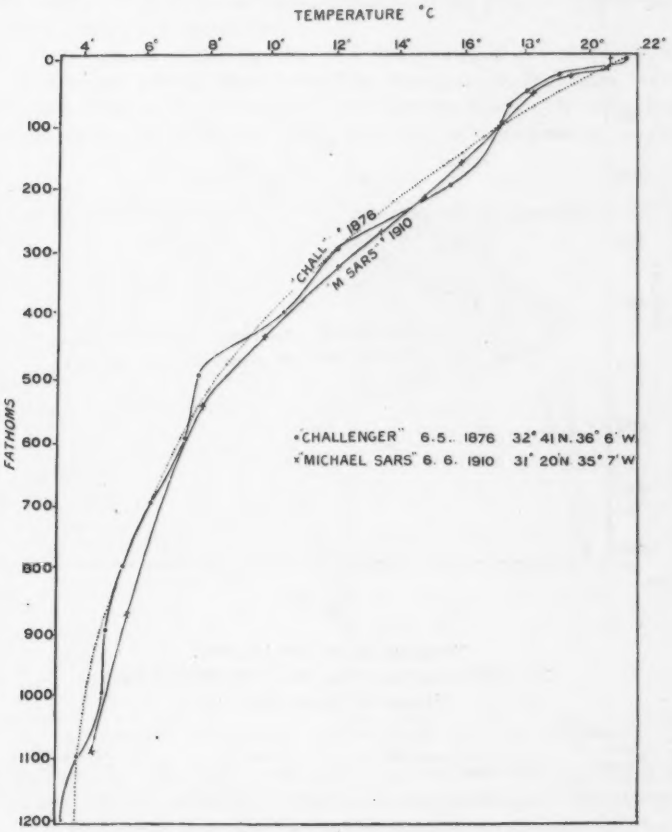


Fig. 5

TEMPERATURE OF *CHALLENGER* AND *MICHAEL SARS'* EXPEDITIONS.

very great fluctuations from year to year in the degree of warmth in these mid layers that they even exceed the fluctuations in the seasons.

It is obvious that fluctuations of this kind in the degree of warmth of the Atlantic ocean are most important and need further investigation. In the Norwegian sea such fluctuations in water flowing in from the Atlantic have been already previously investigated by the *Michael Sars*.

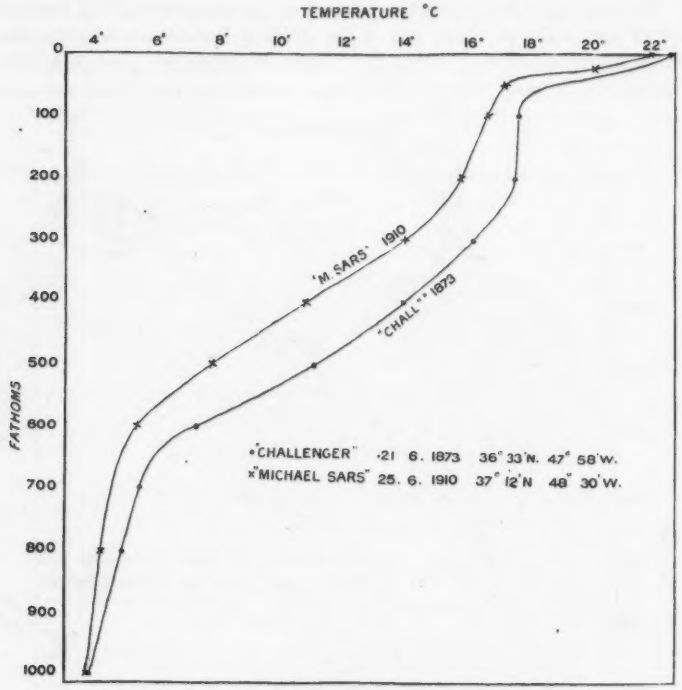


Fig. 6

TEMPERATURE OF THE ATLANTIC.
June, 1873 (*Challenger*), and June, 1910 (*Michael Sars*).
Difference of Temperature (° *C.*)

Depth, Fathoms.	A Between *Challenger*, stat. 65. and *Michael Sars*, ,, 65.	B *Ch.* stat. 66. *M.S.* ,, 63.	C *Ch.* stat. 69. *M.S.* ,, 60.
0	0°·6	+ 1°·2	2°·3
100	1°·1	0°·5	0°·8
200	1°·7	1°·2	1°·6
300	2°·2	3°·7	2°·8
400	3°·2	4°·8	2°·8
500	3°·2	4°·3	2°·0
600	1°·9	1°·9	0°·7
800	0°·7	—	—
1000	0°·1	—	0°·4
	Ch. 65, 36° 33′ N., 47° 58′ W. *M.S.* 65, 37° 12′ N., 48° 30′ W.	*Ch.* 66, 37° 24′ N., 44° 14′ W. *M.S.* 63, 36° 5′ N., 43° 58′ W.	*Ch.* 69, 38° 23 N., 37° 31′ W. *M.S.* 60, 41° 39′ N., 51° 4′ W.

These determinations of the temperatures and salinities of salt water will subsequently be utilized for dynamic calculations. It will thus be possible to draw conclusions as to the *movements* of the different water-layers. These movements the expedition endeavoured also to investigate by means of direct *current measurements* with the propeller current-meter which *Ekman* has constructed.

In the Strait of Gibraltar we tried first to anchor one of the lifeboats fore and aft, as had often been done previously in Norwegian waters. However, the strong current broke the lines repeatedly. We accordingly anchored the ship itself, with $1\frac{1}{2}$-inch steel wire and a warp anchor, in about

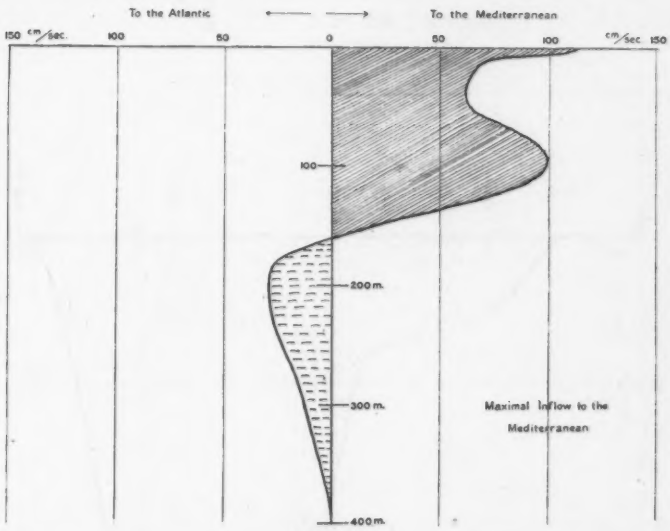


Fig. 7

MOVEMENTS AT DIFFERENT DEPTHS IN THE STRAIT OF GIBRALTAR.

200 fathoms. The ship lay thus on April 30, from 2.30 a.m. till 5 p.m. During this time we took seventy measurements at eight different depths.

Figs. 7 and 8 show the results of these measurements, calculated for the direction along the axis of the Strait.* The water-layers flowing into the Mediterranean are indicated by oblique lines, and the layers going out into the Atlantic by broken lines. Fig. 7 gives the conditions at 9 a.m., when the inflow into the Mediterranean was at its height. Fig. 8 gives the average of the measurements at 2 o'clock in the morning and 3 o'clock in the afternoon. A comparison of the two figures shows that the effects of the tidal water are very great throughout the

* In working up these results Dr. Helland-Hansen has been assisted by Dr. Hanzlik, of Prague.

whole mass of water from the surface to the bottom. The horizontal scale give the velocities in centimetres per second. During the inflow

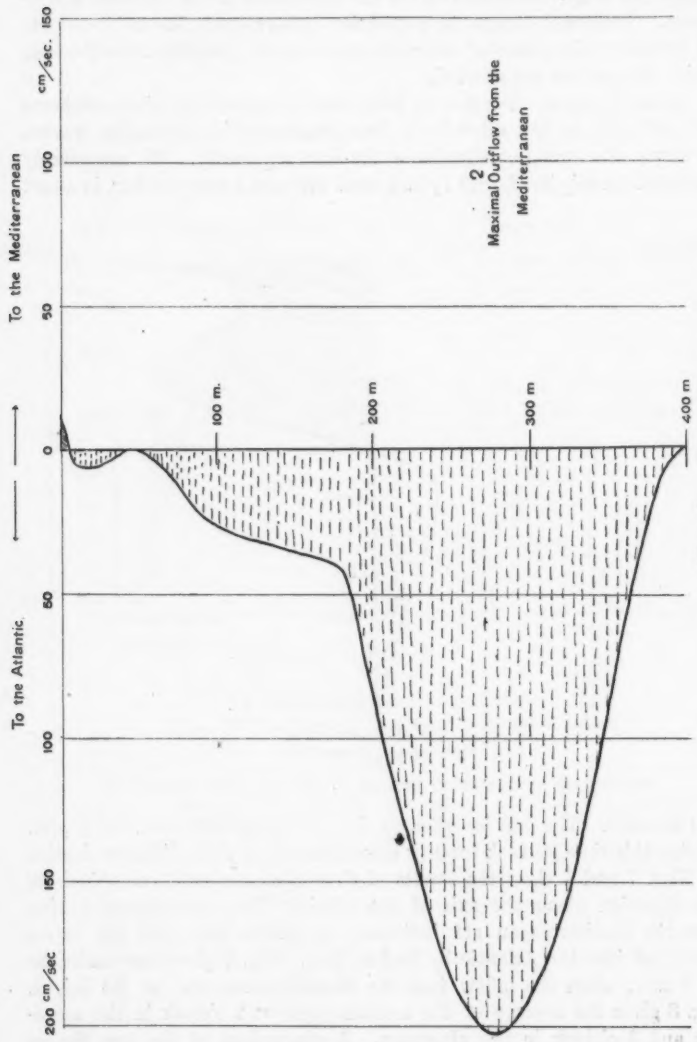


Fig. 8

MOVEMENTS AT DIFFERENT DEPTHS IN THE STRAIT OF GIBRALTAR.

(Fig. 7) the velocity in the upper instreaming layer was about 1 metre per second, while in the lower west-flowing layer it did not exceed $\frac{1}{3}$ metre. During the *outflow* from the Mediterranean to the Atlantic (Fig. 8) there

was hardly any surface current, whereas the outward current at greater depths (300 metres) had a velocity as much as 2 metres per second. The real velocities were actually greater, as the current generally ran in a slightly oblique direction to the axis of the strait.

During our experiments with the large otter trawl on the bank south of the Azores on June 12, our trawl stuck fast on the bottom. Instead of immediately getting it clear, this otherwise unfortunate circumstance was made use of for taking current-measurements. The ship was thus anchored to the trawl at a depth of 524 fathoms (958 metres). In all we took ninety measurements at various depths down to 800 metres.

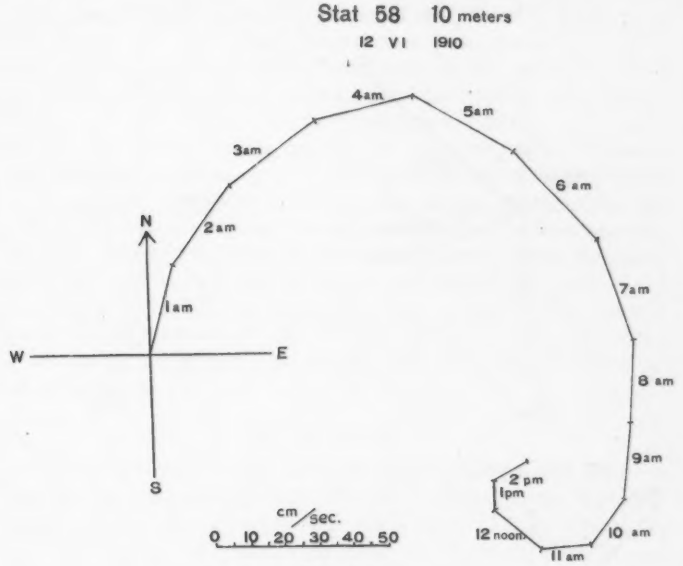


Fig. 9

CURRENT FROM HOUR TO HOUR AT DEPTH OF 10 METRES.

Fig. 9 shows the current from hour to hour at a depth of 10 metres. *The tidal movements can be distinctly seen.* The actual main current ran southwards with a velocity of 8–9 cm. per second.

In Fig. 10 we see the currents in the different layers at three intervals of time—I. at 3.30 a.m.; II. at 7 a.m.; III. at 10.45 a.m. On comparing the three figures we find that at all depths down as far as 800 metres there were tidal movements; the arrows all point to the right from I. through II. to III. On the whole the currents in the deeper layers flowed in a contrary direction to the movements in the upper ones. There was a strong current at 800 metres at 3.30 a.m.; but otherwise we found as a

rule that the current was strongest close to the surface, while at 100 metres the velocity decreased and increased again at 200 metres.

The measurements show accordingly that there may be very considerable tidal currents even down as deep as 800 metres. The reason why they were so strong south of the Azores is probably to a great extent because the bottom there forms a large shoal, which the water presses up against.

Similar investigations with modern methods have never been undertaken before either in deep water or in the Strait of Gibraltar.

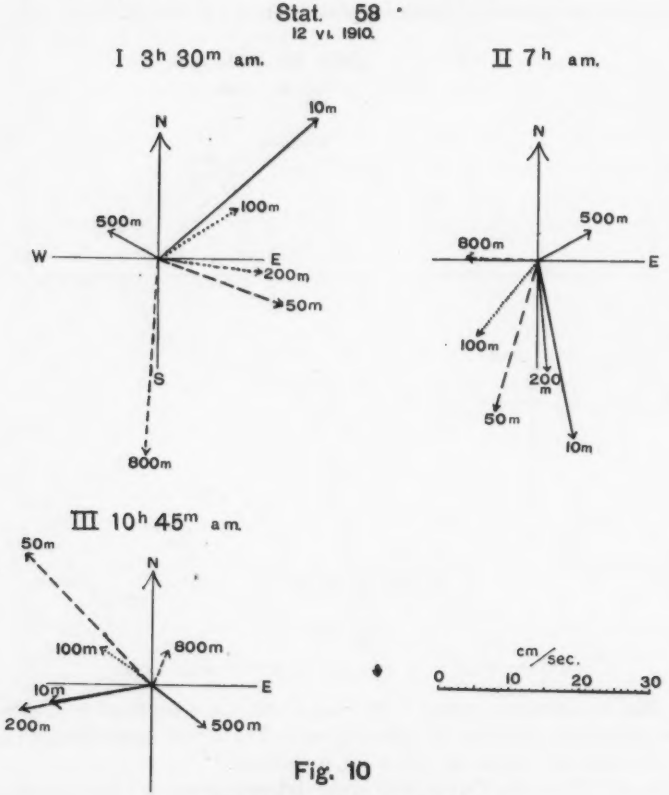


Fig. 10

CURRENTS IN DIFFERENT LAYERS.

That there are tidal movements in the open sea and such strong currents, even at depths over 400 fathoms (800 metres), is interesting for many reasons, as it assists us in understanding the ocean currents, the tide-wave, the distribution of living organisms, and of the deposits along the bottom of the sea.

It has long been a puzzle to find that at great depths in the sea there are stones which are not covered by deposits, though they must undoubtedly have lain at the bottom for a long period of time. On the slopes of the coast banks south-west of Ireland, we shot our trawl in about 1000 fathoms (1797 metres), and found, *inter alia*, numbers of stones.

Sir John Murray has given them to Dr. Peach for examination. As mentioned in Sir John Murray's lecture to the Royal Scottish Geographical Society in Edinburgh, on November 11, 1910, Dr. Peach "reports, that fully 20 per cent. are glaciated fragments. They consist of granite, gneiss, shales, sandstones, chalks, limestones, and flints, and some of these contain fossil remains. The condition of these fragments shows that in many instances they projected above the surface of the deposit in which they were embedded. Dr. Peach has no doubt that these stones were carried by ice during the later phases of the glacial period to the position in which they were found. They almost all belong to the series of sedimentary, metamorphosed, and erupted rocks now found *in situ* in this country and in Ireland. But the interesting question is: why have these fragments not been completely covered up by the shells which are continually falling from the surface? Telegraph engineers give reasons for believing that in some localities and depths the rate of accumulation is at least one inch in ten years; at this rate all rock fragments deposited during the glacial period should have been buried in the ooze far beyond the reach of the trawl. Most probably the tidal currents, which our observations showed to exist in deep water, extend right down to the bottom and remove the small Globigerina shells from any ridges. Still there may be other explanations of the facts." *

Phytoplankton.

Throughout the whole cruise of the *Challenger* the forms of plankton collected by the tow-nets were determined, as published in the Summary of Results, and a first attempt was made by Sir John Murray to estimate the quantity of calcium carbonate, in the form of shells and skeletons secreted by plankton organisms, to be found in a mass of ocean water 100 fathoms in depth by a square mile in area. The detailed examination of the Phytoplankton of the North Atlantic, with numerical determination of the individuals of different species, was first undertaken during Hensen's expedition in 1889, the results of which, by the way, have not yet been fully treated. Our knowledge has been further extended by the extensive researches of Cleve, and by valuable contributions from G. Murray, Whitting, and Blackman. The *Valdivia* expedition carried out the greater part of its investigations in the Antarctic and Indian oceans, *the researches in the Atlantic* being comparatively few. Our knowledge regarding the distribution of species in the Atlantic is, notwithstanding, still very incomplete.

* *Scottish Geographical Magazine*, December, 1910.

The samples taken by tow-nets in the open sea could not any of them compare in quantity with what can be obtained in the coastal waters in the Norwegian sea. The only exceptions are the series taken to the west of Ireland and in the Bay of Biscay during April (stations 2, 3, 4, 7, 9, 10), where we met with large quantities of diatoms, even down to depths of over 100 metres.

The oceanic samples are, however, very rich in species, there being, as a rule, at least 50 species in every single sample from the upper layers down to a depth of 100 metres. Many of the species are so sparsely represented that it has only been possible to find a few individuals, but the majority of them have, in spite of their scanty numbers, a wide distribution throughout the warm seas, and they have also been found in the Indian ocean (*Valdivia*) and the Pacific (Kofoid). A few of them have not yet been described, though most of them are known from previous investigations. It will be a difficult matter to characterize the groups of species according to their geographical distribution within the area investigated; it can perhaps be done when our material has been fully treated, but certainly not as yet. All we can do at present is to distinguish the subtropical species from those which belong to temperate waters, and the oceanic species from the ones which have their centre of distribution along the coasts.

The various groups of plankton algæ adapt themselves in an entirely different manner to oceanic conditions of existence, and must, therefore, be treated separately.

1. *Cyanophyceæ*, or the bluish-green algæ, have comparatively very few pelagic representatives, but they include, on the other hand, several which are characteristic forms of the tropical seas. *Trichodesmium Thiebaulti* consists of threadlike strings of cells, united in more or less regularly formed yellowish-brown clusters, which in calm weather float up to the very surface, where they can be seen with the naked eye, and where they sometimes congregate in such dense masses as to constitute a distinct layer. The species does not occur outside ocean currents of subtropical origin, and Cleve hit on a characteristic definition of the tropical oceanic plankton in the Atlantic when he called it Desmoplankton. It was found at all stations from the Canary islands to the Newfoundland banks, and from there to the coast banks off Ireland.

Cyanophyceæ are not found pelagic in temperate or arctic marine areas, though a few species may occur in the summer in brackish water like the Baltic. In shallow fresh-water lakes, too, other species sometimes form the so-called *water-blossom* during the hottest part of the year.

2. *Diatoms* occur at times in larger *quantities* than any of the other plankton algæ, and they are to be found in all seas, from polar regions where the temperature is below 0° to the tropics, and along the coasts as well as in the open sea. Most of the species are restricted to the shallow coastal seas, and they form resting spores with thick cell walls

which sink to the bottom and ensure the survival of the species at unfavourable seasons of the year. However, there are also some species which are purely oceanic.

The diatoms, which are characteristic of the tropical and subtropical portions of the open Atlantic, are comparatively few, though some of them are quite characteristic: *Coscinodiscus rex*, the largest of all the pelagic diatoms, appears to the naked eye as a yellowish-brown bladder, over a millimetre in diameter; the cell-contents form quite a thin layer along the finely sculptured cell wall. *Planktoniella sol* and *Gossleriella tropica* are discoidal cells with a peculiar swimming apparatus radiating out from the edge; Planktoniella has a collar built up of delicate compartments, and Gossleriella a crown of fine silicious fibres.

The genera which predominate in temperate seas (Chætoceras, Rhizosolenia, Thalassiothrix) are in their way just as well equipped for a pelagic existence, and their swimming apparatus shows quite as many variations. But they need also just as much to increase their superficies and swimming powers, since in temperate seas they may be often swept into ocean currents with lower salinities and densities, where they often multiply prolifically. It should be mentioned that several of the oceanic diatoms, which are characteristic types of colder seas, are also to be found in smaller quantities even at the warmest stations, and this is especially the case with those species that occur in abundance in both the Arctic and Antarctic oceans (*Thalassiothrix longissima*, *Rhizosolenia hebetata f. semispina*); they cannot, therefore, be strictly regarded as examples of bipolar distribution.

The distinction between the coast plankton and oceanic plankton does not appear to be so easy to draw in the warm seas as it is in temperate waters. In our latitudes some of the coast plankton rest for several months during the darkest period of the year, while other species rest during the summer. Early in the spring the actual coast plankton is restricted to the shallow coast banks, but in the course of the summer and autumn a larger or smaller number of species is apt to follow the surface currents out to sea, where, however, they play quite a subordinate part compared with the oceanic species that are developed on the spot.

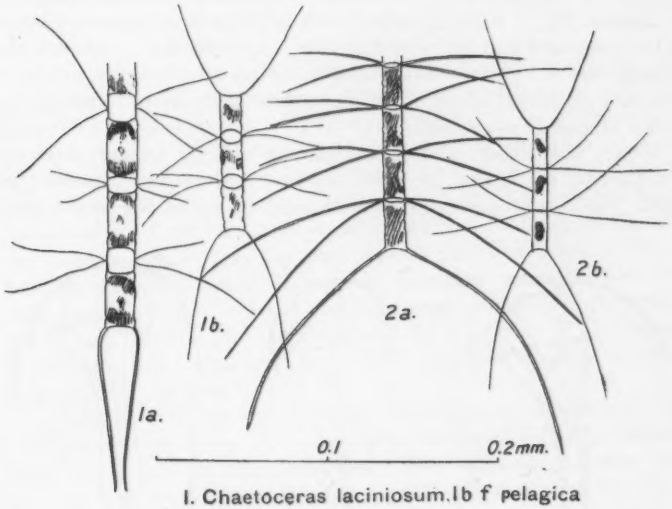
In warmer waters the diatoms of the coast plankton appear able to remain for a longer period outside their own particular areas than they do with us: very few of the plankton samples which we collected from the surface layers were entirely devoid of diatoms that properly belong to the coasts; they are found, as a rule, in small quantities, and are by no means so robust in their structure, having thinner cell walls and smaller dimensions than the corresponding forms near the coasts; they are, however, all the same undoubtedly capable of surviving. One characteristic instance of long wanderings to oceanic regions on the part of such degenerate coast forms we were able to account for in the course of our investigations. South of Iceland, from May to July and well on into the autumn, previous observers found a community of degenerate coast diatoms, especially

Chætoceras Schüttii and *Ch. laciniosum*, which occurs at times in large quantities in water of a salinity high enough to characterize it as unmixed Gulf Stream water (see Fig. 11). This community is totally distinct from the Iceland coast plankton, and it is quite out of the question to imagine that the algæ may have wandered out from the Iceland coast. Now, we found on our cruise exactly the same species in exactly the same degenerate forms in the Gulf Stream, out beyond the east coast of North America, so that they must undoubtedly have been carried off by the stream from the American coastal waters. As soon as the current carries them to the localities where conditions of existence are favourable for their development the diatoms increase in great abundance, but retain the weak structure and small dimensions which Professor Gran has understood as a sign of degeneration.

3. *Peridinea* form, along with diatoms, the bulk of the plankton that we obtain by means of tow-nets. By far the most of the species are purely oceanic, and the greater part of them belong to warm seas; and here, too, we find a much bigger variation in the organization of cells than we do in temperate ocean currents. As an instance may be mentioned the family of *Dinophysidæ*. In the northern temperate Atlantic ocean this family is represented by a few species of the genus Dinophysis (see Fig. 12). The commonest of these, *D. acuta*, consists of a linguiform compressed cell, furnished with two cilia. One of the cilia oscillates freely alongside a membrane on the one side, the other lies protected between two ring-shaped membranes near the anterior portion of the cell. The alga remains floating in the upper layers by means of the movements of its hair-like lash; its body is comparatively heavy.

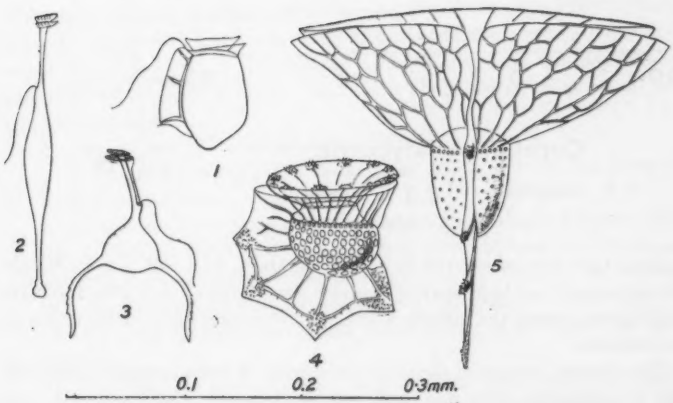
In warm seas we find an extraordinary variety of this type. In some genera the swimming apparatus is developed out of the different organs of the cell. The *Amphisolenia* have their whole cell drawn out into a hair-shaped formation, which carries the ring-shaped membranes on a little head at the anterior end. *Triposolenia* has the middle portion of its cell rounded, the head and membranes are placed on a long neck, and posteriorly the cell terminates in two curved thin legs which are not in the same plane.

Other genera have kept the cell-form almost as in Dinophysis, but the membranes are converted into swimming apparatus; in some cases the membrane at the side is the most highly developed, so that it also includes the posterior portion of the cell, and is stiffened with ramifying ribs (*Ornithocercus magnificus*); in others the ring-shaped membranes are changed into a complete parachute, which is also stiffened with ribs (*Ornithocercus splendidus*). A similar capacity for variation is likewise to be found in other families, chief among which may be mentioned Ceratium, the most important genus of them all; of which some species vary to a great extent, and can increase or reduce their superficies according to the density of their surrounding medium. The expedition has collected excellent



1. Chaetoceras laciniosum. 1b f pelagica
2 Ch. Schuettii 2b f Oceanica

Fig. 11

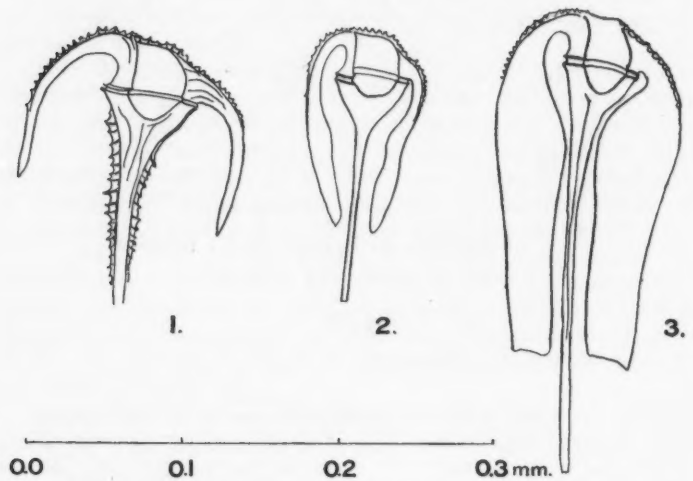


1. Dinophysis acuta. 2. Amphisolenia globifera. 3. Triposolenia bicornis.
4. Ornithocercus magnificus. 5. Ornithocercus splendidus.

Fig. 12

material for studying these variations; one species, *Ceratium platycorne* for instance, Fig. 13, is distinguished by the fact that its two posterior horns can be converted into flat wing-like swimming apparatus; towards the northern limit of its area of distribution it changes over, however, to a form with quite cylindrical horns, which caused it to be described formerly as a distinct species, *C. compressum*.

We are able to collect all these organisms with the ordinary tow-nets of miller-silk, the meshes of which are 0·04–0·06 mm. in diameter. In coastal waters they sometimes occur in large quantities, but in the open



Ceratium platycorne.

1. F. compressa. 2 3 F. normalis.

Fig. 13

Atlantic they are only found in scanty numbers, as a rule not more than ten individuals per litre of all the species put together; and this, too, even in the layers nearest the surface, which afford the most favourable conditions for existence.

The greater portion of the plant substances in these oceanic waters consists of organisms, 0·02 mm. and less in diameter, which generally pass through the meshes of even the finest tow-nets; and the most valuable botanical result of our expedition has been that we have shown the possibility of examining these organisms throughout the whole cruise in their living state, and of determining the quantities of the different species occurring in each litre of sea-water at different depths.

As early as the *Challenger* expedition, Sir John Murray drew attention to their importance, as he found that the stomach-contents of salpæ mainly consisted of these small organisms, and he could also demonstrate their existence in sea-water on several occasions.

Later on Hensen made improvements in the tow-nets, assuming apparently that he could by means of them secure specimens of everything living that floats in the sea. When, accordingly, after his great expedition in 1889, he was unable to show any substantial quantities of smaller organisms, people began to doubt their existence, or at any rate their significance. George Murray pointed out anew that the principal family, the calcareous flagellates, is universally distributed throughout the seas; and Lohmann, whose plankton investigations have done much to improve both our knowledge and methods, made systematic researches with filters of fine construction, to ascertain their occurrence, especially in the Mediterranean and Baltic. He also introduced for the study of the smallest organisms a little hand centrifuge, which has done excellent service in waters rich in plankton.

During the *Michael Sars* expedition we employed, in addition to this, a large centrifuge driven by steam-power, which enabled us to centrifuge more than a litre of water at a time. The water-samples were taken up with water-bottles from different depths, and as a rule 300 cm. of each sample were subjected to the centrifugal machine. The water at the bottom of the centrifuge glasses, which contained the plankton algæ, was concentrated by means of a little hand centrifuge; so that it was possible to place the whole contents in a single drop of water below the microscope.

In this way we were able to study the quantitative occurrence of the different species at different depths during the whole expedition. We succeeded in discovering a whole series of quite unknown forms (see Fig. 14), especially in the case of the calcareous flagellates; and our investigations also enabled us to get a much clearer idea about the distribution of plants in relation to depth.

To sum up, our chief results are as follows:—

1. The quantity of plankton in the open Atlantic is far less than what is found in coastal seas.

2. At most of the stations where investigations took place the maximum of plant-substance was found at a depth of about 50 metres; it was, as a rule, scanty in the immediate neighbourhood of the surface, but appeared to be almost as abundant at 10 metres as at 50 metres. There was thus about the same quantity of plants all the way down from 10 metres to 50 metres.

At 75 metres the quantity was, as a rule, not more than half what we met with at 50 metres, and at 100 metres there was only about a tenth part.

This was the case with oceanic water. Where there was an admixture of coastal water, and an evident distinction between the surface layer and the deeper layers, the surface layer was comparatively richer in plants.

3. The different species are distributed, each in its own characteristic fashion, in regard to depth. The peridinea keep comparatively near the surface, the diatoms prefer the deepest layers, while the coccolithophoridæ occupy an intermediate position.

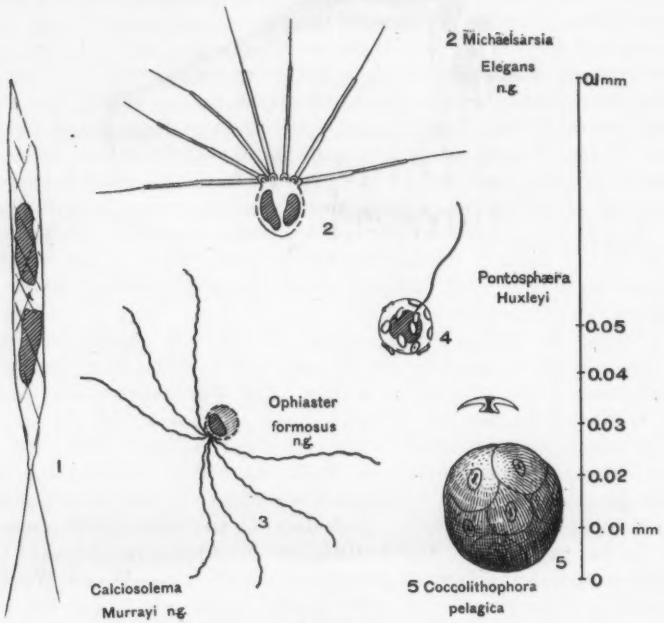


Fig. 14

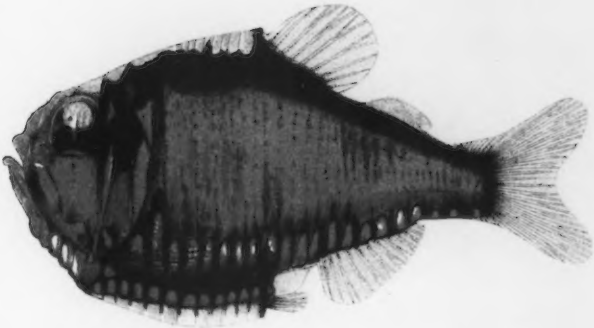
4. The number of living plant cells in the open Atlantic throughout the most densely populated water-layers (10–50 metres) varies, as a rule, between 3000 and 12,000 cells per litre of sea-water. Of these, about half are coccolithophoridæ, the rest being peridinea cells with a few naked flagellates and a sprinkling of diatoms.

The Larger Organisms.*

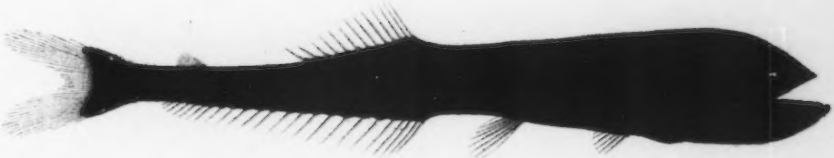
Deep-sea Fishes and Crustaceans.

Since the *Challenger* expedition laid the first foundation of our knowledge regarding the animal world of the deep sea, many succeeding expeditions have bountifully added to our store. As an instance, I may mention that we now know one thousand different species of deep-sea

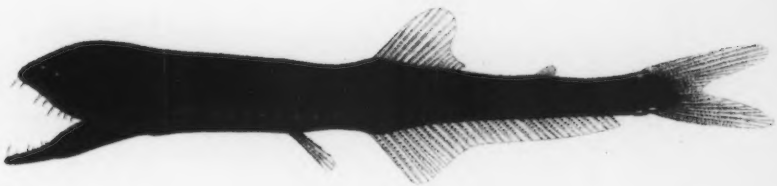
* In working up this material I have had the assistance of Mr. Einar Koefoed, Mr. Einar Lea, and Mr. Oscar Sund.



ARGYROPELECUS AFFINIS, GARM.



GONOSTOMA GRANDE, COLLETT.



GONOSTOMA ELONGATUM, GTHR.

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fishes, and that the German *Valdivia* expedition alone discovered no fewer than sixty-three new species.

Regarding these many species, however, only very little is known. In the case of quite a number of them we are acquainted merely with one, or, at most, a few specimens, while we are in almost complete ignorance as to their biology, their propagation, development-history, growth, and outward conditions of life.

The view which generally prevails in literature nowadays is, that the sea contains a motley abundance of forms either along its bottom or floating within its waters, subject to a uniformity of outward conditions of existence —that is to say, passing their lives in absolute darkness—and in a medium with constant temperature and other physical surroundings.

To biologists this view concerning the animal life of the deep sea has presented many difficulties. How is it that in a constant medium of the kind conceived there exist side by side so many distinct forms? And how, again, can animals with large eyes manage to live alongside blind forms? Why are some species furnished with numerous highly developed light-organs, while in the case of others these are entirely wanting? And how, too, comes it that within the same groups of animals, very often in closely related species, the colours vary so remarkably, although the outer medium is the same?

These questions have become all the more pressing now that biological ocean research has discovered instances where in the same area of the sea there occur many different animal forms, each possessed of its own peculiarities in mode of life, habitat, and other respects, so that each species has its own characteristic area of distribution, even though it may occasionally be found together with its neighbours in the same catch. Our study of the spawning-grounds of the cod family (*Gadidæ*) in the North sea and Norwegian sea has shown us, for instance, that each of seventeen species has its particular spawning area, each species during the spawning period seeking out distinct characteristic depths, temperatures, and salinities; so that just as from a morphological point of view the species may be characterized by a definite form or structure, so, too, it is possible, to characterize it by certain well-defined conditions of existence. These conditions characterize a given species quite as much as any morphological description, and in fact, for a proper conception of the species, both methods of investigation are supplementary.

Now, if we wish to investigate the conditions of existence under which animals live, we must naturally first of all ascertain *where* they live, which, in the sea, will be tantamount to discovering *the depth* where they flourish. This alone can enlighten us regarding the conditions of light, of temperature, and of salinity which are requisite for their existence.

Our knowledge regarding the haunts of the smaller organisms has advanced greatly in recent years owing to the fact that we have made use of small closing nets. But, with regard to the larger animals, especially

fishes, we still possess little knowledge, despite the great exertions made in this direction above all others by the Prince of Monaco and the *Valdivia* expedition.

Sir John Murray seems first of all to have had the idea that fishes may occur in intermediate layers. Thus, Gunther, in his treatise on the '*Challenger* Deep-Sea Fishes,' says—

"I formerly assumed that the fishes of the open sea were living either near the surface or at the botton, but I think now that Mr. Murray is right in supposing that certain fishes live habitually in intermediate strata, without ever coming to the surface or descending to the bottom."

The *Valdivia* expedition made a special endeavour to ascertain the approximate limits of depth within which the various species of fish occurred. Brauer's excellent work on 'Fishes of the Deep Sea,' describes the efforts of the expedition in this direction. To a certain extent they made use of closing nets, but in these they only succeeded in capturing five out of the 151 species of pelagic fishes secured by the expedition. They also made the experiment of sinking bag-nets to different depths at the same station (graduated catches). In the Gulf of Guinea they took by this means (at station 66) in a haul with a large bag-net, from a depth of 3000 metres to the surface, thirty specimens of *Cyclothone livida*, whereas in a haul from 700 metres to the surface at the same place no specimens of this species were obtained; in this manner they elicited a great deal of valuable information regarding the depth at which the different species occur, though, as Brauer himself confesses, they did not succeed in defining the *upper and lower limits within which the deep-sea fishes live.*

When fitting out the *Michael Sars* expedition, I kept ever in mind that one of the most important of all our aims should be to try and develop a method which would yield more information regarding the vertical distribution of deep-sea fishes.

My first idea was to devote the bulk of our work to very large closing nets, and we accordingly constructed two excellent closing nets 3 metres in diameter at the mouth, one being of silk and the other of fine shrimp-net, by means of which during the expedition we made some very successful hauls. On thinking matters over more carefully, however, I realized the many serious deficiencies of vertical closing nets. Their chief fault is that they catch far too little.

We may take it for granted that the larger fish, at any rate, are only caught by pure accident, as it is always single specimens that are secured. It is the smallest forms which occur in large quantities, and especially the genus Cyclothone, which alone can be investigated with instruments of this kind. But there is, besides, the disadvantage that it is very difficult to know *exactly* at what depth the net has closed, because it is necessary to calculate the time taken by the slip-lead to reach it, and it would be impossible to stop hauling in without risking the loss of all its contents. A further grave objection is the enormous length of time which these vertical hauls require when the depths are great, as it is necessary to wind in

0.9 cm.

1.2 cm.

1.6 cm.

5.2 cm.

LARVA AND YOUNG OF ALEPOCEPHALUS.

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slowly. Our closing nets were, therefore, merely designed to serve as a check on other methods, and were employed solely for this purpose.

The ideal instrument for capturing the larger pelagic organisms would be a big tow-net or pelagic trawl, which could be sunk closed to the requisite depth, then opened and towed at a carefully ascertained depth, and finally closed again and hauled in. Such an instrument would be capable of capturing many of the larger animals, and it would secure them, too, at known depths. However, an instrument of this kind would naturally be extremely complicated, too much so, in fact, to prove reliable under our present system of working, and it would further entail a great expenditure of time. It would not be possible to operate many of these tow-nets simultaneously (amongst other reasons, because of the slip-leads), and, consequently, it would be necessary to undertake a series of hauls at the different depths.

This being the case, I gave up the idea of trying to construct any such instrument. A more practical plan seemed to be to try and tow a number of instruments simultaneously at different depths, and to compare the catches thus made with each other. I could thereby ensure all the hauls being made at the same time, and would be substituting horizontal for vertical "graduated catches." I hoped, further, by means of long-continued hauls, of, say, a whole night's or a whole day's duration, to reduce the error inherent in this method, namely, that the instruments would be apt to make captures during the process of lowering and hauling in. Provided that catches were large, it seemed to me that the mere numbers would demonstrate *sufficiently convincingly* at what depths the captures had been made.

Thanks to a practical arrangement, we succeeded in towing ten different instruments from two wire lines. It would undoubtedly have been better for purposes of comparison if they had all been alike, but in that case they would have had to be small. To be able to operate as many appliances as possible simultaneously, we had to have small ones (tow-nets) and large ones (Dr. C. G. Petersen's young-fish trawl) alternately, and my experience leads me to assume that they were all towed at a depth about equal to half the length of the wire out. The way they were set naturally depended to a great extend upon conditions on board the ship, but when we had got everything in order, we endeavoured, as far as possible, to make use of the same procedure at every station (see Fig. 15).

The arrangement generally adopted was as follows :—

At the surface	1 silk net of 1 metre diameter.
„ 50 metres	1 „ „ „ „
„ 100 „	1 „ „ „ „
„ 150 „	1 young-fish trawl.
„ 300 „	1 silk net of ¾ metre diameter.
„ 500 „	1 young-fish trawl.
„ 750 „	1 silk net of ¾ metre diameter.
„ 1000 „	1 young-fish trawl.
„ 1250 „	1 silk net of ¾ metre diameter.
„ 1500 „	1 large tow-net of 3 metres diameter (made of shrimp-net) or a young-fish trawl.

With this, or a corresponding arrangement, we carried out some long hauls at about thirty stations, off the Canary islands, in the Sargasso sea, between the Azores and Newfoundland, and from Newfoundland to Ireland. Some hauls were made in the daytime and others at night.

In this manner we collected a very large amount of material consisting of many kinds of pelagic organisms—fishes, cephalopods, crustaceans, medusæ, etc. I will here merely mention a few instances of the evidences our material affords as to the occurrence of these animals at different depths. To illustrate the method employed, I will begin with the remarkable and well-known *Sternoptychid: Argyropelecus hemigymnus*. Of this species we caught 287 individuals at the different stations, widely distributed over

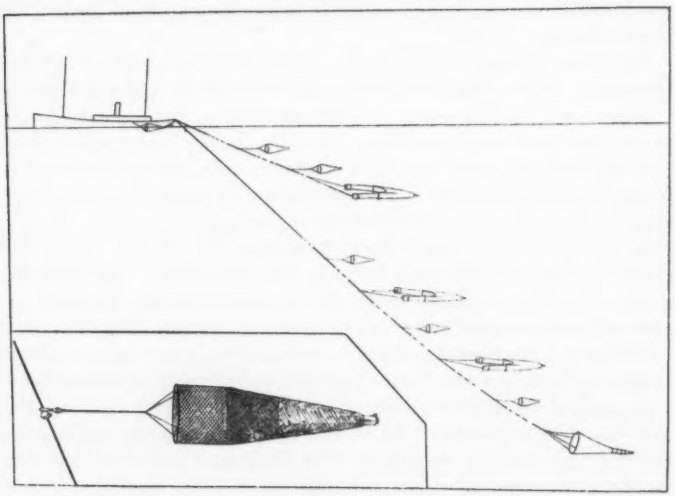
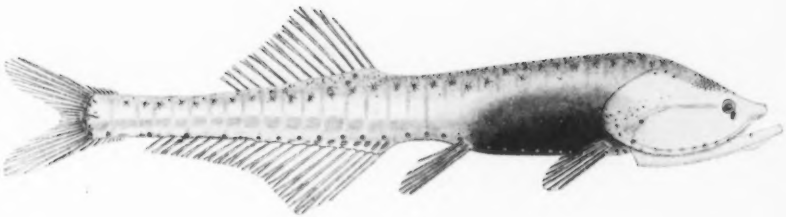


Fig. 15

TOW-NETS AT DIFFERENT DEPTHS.

the Northern Atlantic. Now, if we arrange the 287 individuals according to depth, we get the following table :—

At the surface	0
„ 50 metres	0
„ 100 „	0
„ 150 „	62
„ 300 „	156
„ 500 „	48
„ 750 „	0
„ 1000 „	6
„ 1250 „	0
„ 1500 „	11
„ 2000 „	4



2.7 cm.

CYCLOTHONE SIGNATA. 1000 mtr. Wire.

5 cm.

CYCLOTHONE MICRODON. 3000 mtr. Wire.

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The bulk occurred at depths between 150 and 500 metres, no individuals were caught above 150 metres, and only about 7 per cent. were taken at depths lower than 500 metres. If we assume, then, that these 7 per cent. were captured during the process of hauling in the appliances, and that none of them live at depths below 500 metres, we will have an idea of the accuracy of our method.

We see, further, that by far the greater part were caught at a depth of 300 metres, where we generally had out a $\frac{3}{4}$-metre silk net, whereas at 150 metres and at 500 metres the appliance used was, as a rule, a young-fish trawl, that would have had a far greater capacity for catching these fish. It seems, accordingly, that a preponderating majority of the individuals of this species are very strictly limited to an "intermediary" layer, situated at a depth of about 300 metres. A closer investigation of the individuals captured at a depth of 150 metres shows that they were all caught at night. This may be due either to an upward nocturnal wandering or to chance, though on this question the small amount of our material makes it unsafe to hazard an opinion: in subsequent investigations, however, it will be worth while taking this fact into consideration. Among the individuals captured at 500 metres there must, at any rate, be a few that were taken in the process of hauling in the young-fish trawl through the intermediary layer above, though the majority probably lived at that depth—a deduction supported by the fact that far fewer specimens were found in the young-fish trawl towed at 1000 metres, which may have been captured while hauling in.

This instance gives us a good illustration of our method, with its deficiencies and advantages. It is obvious that the greater the number of individuals we have to deal with, the greater is the probability of obtaining reliable information, and the safer are the conclusions we can deduce from our results. When, therefore, in what follows, I proceed to give some instances of the distribution in depth of different kinds of fish, I will begin by mentioning the commonest, or, at any rate, the most numerously captured forms belonging to the species *Cyclothone microdon* and *C. signata*.

Of these two species we caught altogether over 7500 individuals, which were all measured and arranged according to their length and the instrument in which they were captured, so as to also obtain information regarding the occurrence of the different sizes at different depths. In Fig. 16 I give, in the case of both species, the results of the catches made between Newfoundland and Ireland.

Cyclothone microdon was found during the cruise of the *Michael Sars* in the Northern Atlantic at every station where an appliance was towed in depth below 500 metres. Above 500 metres it was only met with occasionally. At a depth of 300 metres we only came across *one* individual. In depths from 500 metres down to 1500 metres its *quantitative* occurrence appears to be fairly uniform.

In our northern as well as in our southern section we found

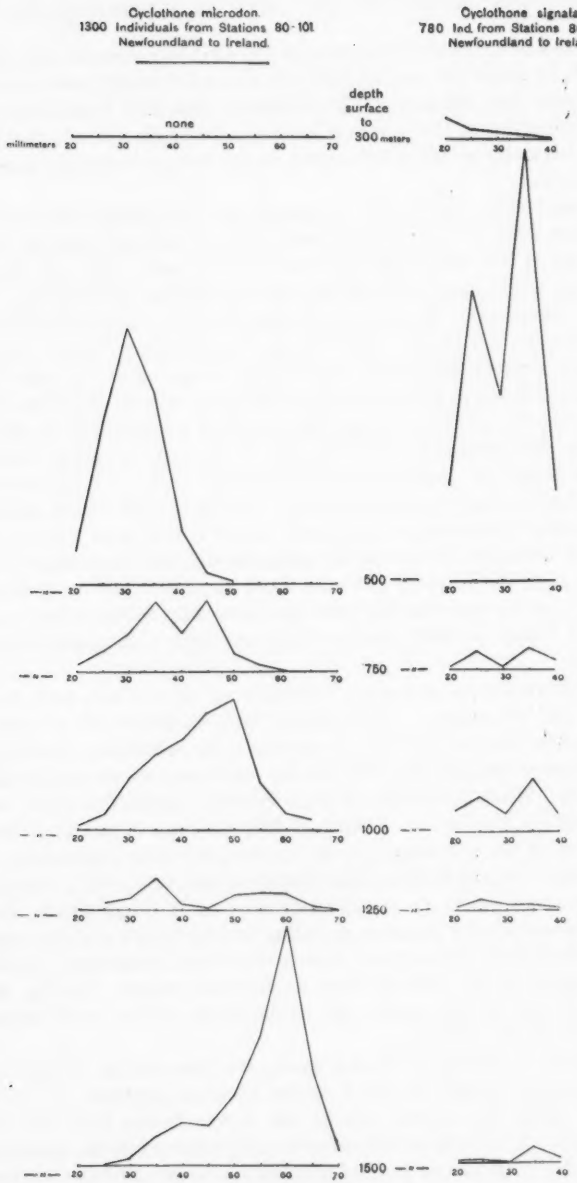

Fig. 16

RESULTS OF CATCHES BETWEEN NEWFOUNDLAND AND IRELAND.

approximately the same number of individuals in each of the three young-fish trawls, which we towed simultaneously, viz. at depths of 500 metres, 1000 metres, and 1500 metres. At depths below 1500 metres we only made a few hauls, though, on the other hand, we carried out some vertical hauls, which allow of a comparison between the quantity met with above and below 1500 metres. At station 63 (in the northernmost portion of the Sargasso sea) we secured 10 individuals in a haul from a depth of 4500 metres up to 1500 metres, and 27 individuals in a haul from 1350 metres up to 450 metres. Accordingly, seeing that the first haul was made through a distance more than three times as great as that of the second, we get the result that there were nine times more individuals in the intermediary layer from 1350 metres up to 450 metres than below 1500 metres. A more complete analysis of the different depths from 1500 metres down to the bottom of the sea (about 5000 metres) would have been very desirable, but, unfortunately, we were unable to spare time for it. It may be that there is a layer at the lowest depths where there are no individuals; and I, for my part, at any rate, cannot help believing that the profoundest deep is far more poorly supplied than the intermediary layer.

(*To be continued.*)

FURTHER EXPLORATIONS IN BOLIVIA: THE RIVER HEATH.*

By Major P. H. FAWCETT, R.A.

In March, 1910, I had the honour of reading a paper before the Royal Geographical Society more or less generalizing on South American exploration, its problems and its disabilities. Judging by the letters which I received, and by the comments which it elicited from the Press, it aroused considerable interest amongst those who concern themselves with the progress of geographical research. The difficulties of South American exploration were in no way exaggerated, not even the plague of insects, the long tale of which suggested to some minds, I have no doubt, a fervid imagination. I may say, however, that if any corroboration was required I received it in abundance, even to the tri-coloured Indian, as some paper facetiously dubbed him, and the giant anaconda. That our experiences, as well as the hints of romantic secrets, which I have no personal doubt lie behind the well-nigh impenetrable veil of unexplored forest, should have been received in an atmosphere of incredulity, is of no great importance; for time is an infallible arbiter in these matters.

This year I have been invited to give an account of the exploration which became necessary before the delimitation of the new frontier between Bolivia and Peru could be satisfactorily carried out.

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* Royal Geographical Society, February 13, 1911. Map, p. 476.

In what is known as the north-west of Bolivia, immediately east of the Andes, and contained between that range and the rivers Madre de Dios and Beni, is an extensive triangle of country, some 35,000 square miles in area, known as the Caupolican, whose extremities lie between 11 and 15 degrees S. latitude, and 66 and 70 degrees longitude west of Greenwich. At the southern end of this triangle are the mission villages of Apolo and San Jose, and a few rather isolated squatters in the forest. Further to the north are the small Indian villages of Tumapasa and Ixiamas, very remotely located in the forest of the Beni basin, and subject to occasional attacks by the Guarayo savages. Further to the south the banks of the rivers Mapiri and Caja boast a couple of small villages, a remnant of the once powerful Lejos Indians, and a few small trading stations at long intervals, to the confluence with the Beni, whence the latter is uninhabited to the neighbourhood of the village of Rurenabaque. Except for a single rubber station in the vicinity of Rurenabaque, the Beni is unpopulated to a point below the confluence of the Madidi, and from there is studded at long intervals by the establishments of more or less exhausted rubber concessions. It is quite a mistake to imagine that all the names which occur on the maps of these parts indicate villages or even a single inhabited house. To the south-west the upper Tambopata, connected by a forest track to Apolo, and by a mountain trail to Kohata and the Altiplanicie of Peru, is exploited for rubber by an English syndicate, which means one Englishman and about three hundred Altiplanicie Indians, and is otherwise uninhabited. In the lower Tambopata, where the river bends from the west to the north-north-east, is the Inca Rubber Company's station of Astillero, the limit of navigation for small boats. From this point the river is populated at intervals to the Peruvian Government station of Maldonado at the confluence with the Madre de Dios. From Maldonado to the Bolivian Government station at the confluence of the Heath is deserted forest. Below this point exist various stations to the confluence of the Madre de Dios with the Beni at Riberalta. With the exception of these stations in the main rivers and the small villages already mentioned in the Beni basin, the entire Caupolican is peopled only by savages, the warlike Guarayos, who have held from historical times a more or less undisputed sway over the basins of the Heath and Madidi and the intermediate country, the Chunchos or Echojas of the Tambopata, and the Toromonas on the southern bank of the Madre de Dios. Of these the Guarayos are the most powerful and the most feared.

In 12° 30′ S. and 68° 44′ W., the river Heath (so named from an English explorer killed here by the savages) enters the Madre de Dios, an apparently insignificant and muddy stream. The course of this stream had been agreed upon as constituting a portion of the new frontier, unexplored as it was for more than a few miles from its mouth, because its imaginary course on a small-scale plan seemed to offer a convenient line for the adjustment of conflicting claims.

The first record of any exploration east of the Cordilleras is that of an expedition of Topa Inca Yupanqui, who is said to have crossed the Andes about 1450 with 12,000 men in order to gather in to the Incan Empire the numerous and powerful tribes of Chunchos which held these regions. He is said to have failed in this object owing to the enormous mortality of his troops and to the warlike character of the tribes, but is reputed to have left two fortresses in the Caupolican, whose locality has not hitherto been traceable, and a very fine road, vestiges of which, in immense stone viaducts some 300 feet in height, are still supposed to exist in the forest somewhere between Apolo and San Jose.

Now, it will be remembered that, subsequently to the conquest, Gonzalo Pizarro carried out two years of exploration in the upper Amazon in search of a reputed El Dorado which never materialized. This same El Dorado, which in Southern Peru went by the name of Ambaya or Paititi, furnished the impulse which led to the exploration by the Spanish conquerors of the forest regions lying to the east of the Andes. Treasure and blood were squandered wholesale over this search for an apparently phantom empire, reputed to be fabulously rich, and which, in fact, did not lack some circumstantial evidence of its existence. For instance, a priest named Chavez in the sixteenth century recorded having actually visited the capital and seen its riches in gold, silver, and amber; while another priest gloried in having got within twelve leagues of it. The Grand Paititi, indeed, is familiarly spoken of in the chronicles of early Spanish exploration, and was reputed to exist on the shores of a great lake in a hilly region rich in gold and silver, somewhere amongst the furthest outliers of the Andean range. The forest Indians were emphatic in its existence, and showed, according to the accounts, knives and other manufactured goods asserted to have been exchanged with a white people who came periodically to the capital from some distant civilization. Seventeen Government and numerous private expeditions searched for it in vain. The great lake of Rogagua, in the plains of Mojos east of the Beni, was believed at one time to be its locality; but this is a region of flat plains subject, so far as is known, to annual inundations; and although little known to the present day, the savages, as in the upper Beni where they were originally so numerous, have disappeared. It is not an extravagant supposition that some sort of Indian civilization, commonly called savage, may have existed in, or migrated to, those vast spaces of unexplored country over the Brazilian borders, of which nothing is still known beyond that they are thickly populated by savages, difficult to reach, and dangerous if not impossible to enter—regions which involve two months of trying journey to reach the outskirts of. In the face of the numerous expeditions which have disappeared and probably have been massacred, and in the total absence of any reliable information, rumours of strange peoples cannot wholly be condemned.

It is interesting to note that, after the exploration of the course of the river Heath this past year, there still remain something like 10,000 square miles of the Caupolican into which it is believed that no white man has ever entered. This region I propose to traverse diagonally this year after completing the boundary work with Peru.

In Bolivia, as in other parts of the continent, the diseases of civilization, measles, small-pox, influenza, and the rest, have swept away whole populations of the indigenes; while in later years an unscrupulous exploitation of the savages by rubber-hunters, either to exterminate them or to secure forced labour, has barbarously wasted a very valuable asset. It is known historically that the forests of Caupolican and Mojos were thickly populated, and that the population received a heavy increment from Incan refugees on the destruction of their empire.

The names principally associated with the exploration of the Caupolican are Pedro de Candia and Juan Alvarez Maldonado, the latter of whom explored the main river system and practically opened the river-banks to civilization. The story of every expedition has been, however, the same; a land journey over the mountains to Apolo or its neighbourhood, beyond which transport difficulties forbade advance; journeys *viâ* Sta. Cruz into the plains of Mojos; or the descent and ascent of the main navigable rivers on rafts or in canoes—the Madre de Dios, for example, or the Beni or Diabeni, as it was originally called; fighting with the savages from the first moment of entry into the forests until the last moment of departure. Protracted inland forest journeys have always proved impracticable. The immense difficulties under which these expeditions laboured are scarcely intelligible to those who have no practical experience of South American forests. They are, however, contained in the old records so far as words can describe them. Here, for instance, is a description given by one of the early pioneers of the western Caupolican:—

"Mountain torrents with an impetuosity capable of destroying everything in their course; voracious wild beasts; gigantic and poisonous reptiles; legions of insects more poisonous even than the snakes; precipitous and practically inaccessible hills in which dangers lurk at each step, now of slipping over a precipice, now of being bitten by some poisonous snake or one of the equally venomous ants should one grasp a tree to save a fall; rotten and impenetrable forests; immense lagoons and impassable swamps; torrential rains; inundations; constant damp and fevers of a thousand forms; troublesome and dangerous ulcers; and an absolute lack of food supplies." Through a portion of this delectable region runs part of the frontier between Bolivia and Peru. This is not an exaggerated picture of the western Caupolican to-day, away from roads, rivers, and civilization. Off the beaten track indeed the conditions remain the same, with the single exception that where the old Incan trails over the mountains provided a precarious means of reaching the low

country, there are now comparatively safe mule-tracks, and perhaps it is to-day a little easier to starve.

These expeditions took place principally between 1550 and 1660, subsequently to which date practically the entire region east of the Andes, excepting the few mission stations in the Beni and the Jesuit mining establishments further to the south, was abandoned to its indigenes. It was not until the middle of the nineteenth century and later years that the lower Beni, the Madre de Dios, and other main rivers were re-explored on the rising importance of the industry in rubber. Maldonado, Dr. Heath, Vaca Diez, and General Pando, all made notable explorations. In 1893 General Pando, ex-president and probably the best-known explorer in Bolivia, ascended the upper Madre de Dios, the Tambopata, and the Inambari. In 1896 he entered the Heath, ascended some distance, but losing five men killed by the Guarayos and subjected to such hostility that he was forced to the expedient of ostensibly pitching camp and actually sleeping some distance from it, he crossed to the lower Madidi and Beni. In 1897 he passed from Apolo by an existing track to the upper Tambopata and rediscovered its larger tributaries, now known as the Lanza and Colorado. In 1903 a Peruvian force under Señor Villalta, availing himself of the opportunity afforded by the Bolivian trouble in the Acre, attempted the ascent of the Heath, but was attacked by the savages, and driven out with loss. Meanwhile, the interior of the Caupolican, together with the rivers Heath and Madidi and other less important streams, has remained a blank upon the map until the present day; both Bolivia and Peru contenting themselves with the exploration of rivers which, from their navigability, do not offer any serious difficulty.

For some years now, since the rubber industry attained considerable importance to Bolivia and Peru by virtue of the revenues accruing to the export of that product, the question of definitely delimited frontiers has become acute. The claims of the two republics overlapped one another so extensively that the matter was placed in the hands of the Argentine President to adjudicate, with a result which was not very far from leading to hostilities. The two republics, however, agreed to settle their frontier differences between themselves. A provisional line was therefore agreed upon from the Cordilleras of Suchez to the junction of a tributary named the Javerija with the Acre, approximately in 10° 56′ S. and 69° 30′ W., according to the data obtained in my exploration in the upper Acre in 1906. Intermediately the frontier was designed to follow a geodetic line from the confluence of the Lanza with the upper Tambopata to the most westerly source of the Heath, or what would have been more correctly described as the most westerly source of the headwaters of the Heath. The Heath was believed to be a short and comparatively unimportant forest steam, rising somewhere to the north of Puerto Markham in the Tambopata. It had never been successfully explored, for the very good

reason that it was known to be a stronghold of the Guarayo Indians in common with the upper Madidi and the intermediate country; and the Guarayo Indians are regarded with considerable fear and respect by their civilized neighbours.

Amongst various expeditions in the Heath, a Swiss named Heller attempted its ascent from the Madre de Dios about six years ago with sixty men, but was forced to retreat with loss. According to Peruvian officers at Maldonado, half a battalion of their soldiers were driven out on a similar attempt. This probably was the expedition of 1903 to which I have already referred. General Pando, as I have already mentioned, was forced to cross to the Madidi to escape annihilation; and a Bolivian military expedition, in 1909, ascended the river from its confluence for a short distance, attacked a small population of savages, and also crossed to the Madidi and Beni, incidentally leaving the river a little more difficult for the next comers. As I explained in March of last year before this Society, all exploration across, as opposed to expeditions into, these regions depends for its success upon the selection of a limited *personnel*, able, if needs be, to do without transport under usually exceedingly trying conditions. For I have heard the opinion expressed more than once by men who have pioneered the world from the Yukon to the Australian deserts, and then tasted the delights of the South American forests, that nowhere do nature and the savage combine to make exploration work so difficult and so risky as in the remote corners of this continent. I do not propose to enlarge upon the elements which make for these difficulties, for they are described in detail in my paper of March last year. Insects, savages, diseases, lack of food and lack of transport facilities, away from the main rivers, combine to make journeys exceedingly precarious; nor is it merely a matter of organization. Nor should the health and immunity that I personally have enjoyed mislead any one.

There are records of expeditions into the Caupolican ranging from over a hundred to twenty in strength, of which one or two men, and sometimes none, have returned—disasters attributed variously to fever, starvation, or savages, the latter of which are constantly attacking the rubber pickers and the villages on the outskirts of their country.

There is another and very real risk in the custom of some of the tribes to effectually stop exploration, which to them is synonymous with head hunting, by poisoning the water, where, as is sometimes the case, an expedition is dependent upon more or less stagnant sources of supply. I am inclined to think that ignorance of this possibility has brought more than one expedition to a tragic end. For the savage takes every advantage of his perfect forest lore. He is wary, stealthy, almost invisible and certainly inaudible in the forest, and has, according to the old Spanish records, a peculiarly wide knowledge of potent forest poisons. An expedition is rarely rushed, but it may be subjected to sudden fire from concealed positions, or, what is more demoralizing, may be picked off

MALDONADO.

ROAD ON THE ALTIPLANICIE.

THE ALTIPLANICIE OF PERU.

ECHOJAS, RIVER HEATH.

one by one. It is therefore essential to make friends with them if any passage through their country is to be assured.

Moreover, there is another difficulty peculiar to South America. Carriers, even if obtainable in any number for cross-forest work, which is doubtful, are not a practical solution for transport difficulties, because, unlike Africa or other countries where villages, even if savage, occur every few miles, and there is plenty of game, the South American forests provide nothing, with the result that carriers cannot transport more than is necessary for their own subsistence over a comparatively short period. Nor will mules or horses work and live for long in the forest, even if the class of forest permits of their use; and I may say that swamps, bog, and rivers are prohibitive for cargo animals. I mention these things because of the natural criticism that organization is a solution for all such problems.

Now, when the Bolivian Government invited me to undertake the delimitation of this portion of the frontier, it was very clear to me that it was necessary to have some definite data about the Heath, in order to avoid questions which would of a certainty make the work of demarcation futile, owing to the necessity of referring modifications to Congress. I therefore proposed to explore the river Heath thoroughly in 1910, determine its relation to the upper Tambopata, and defer the delimitation to the following year, stipulating, however, that for work which carried somewhat grave risks, I might be permitted to contract in England six non-commissioned officers in place of local peons or Indians, who not only readily collapse under trying conditions, but are exceedingly timid of savages unless in superior numbers. To this the Government at once agreed, and as Peru was anticipating trouble with Ecuador, it also suited her very well to postpone the delimitation; in fact, she cordially joined in the desire to know more about the Heath before forming her frontier commission.

In England I obtained three excellent men, Sergeant Leigh and Corporal Costin of the Rifle Brigade, and ex-Corporal Todd, who had served for some years with me in the artillery. Two more, Mr. Gibbs, an ex-subaltern of the Northamptonshire Regiment, and a young doctor, Mr. Simpson, were contracted subsequently to my departure, and joined me on the road to the forest.

The party was augmented in La Paz by two young Bolivian officers, for whom the Government anticipated that the experience would be useful, and in the Tambopata by an *employé* of the Inca Rubber Company, sent to view rubber prospects. The latter bolted on seeing fresh tracks of savages, and one of the young officers, filled with stories of savage atrocities, developed a serious illness and was left behind in the Madre de Dios. The party ultimately reduced itself therefore to seven, of whom six were Englishmen, and one a Bolivian officer, Captain Vargas Bozo. I attempted to take three Bolivian soldiers from the Madre de Dios into the Heath,

with the idea of utilizing their services to carry the instruments in the upper river; but excellent as these men are for fighting purposes, their inordinate appetites and inability to respond to the work I demanded from all, compelled me to send them back to avoid a certainty of starvation for the rest. The work being purely exploratory, I did not take any technical assistant.

We left La Paz at the beginning of June, crossing Lake Titicaca into Peru for the descent of the Inca Mining Company's road from Tirapata, on the railway to Cuzco, to Astillero, a port of the same company on the river Tambopata, and were subject, of course, to the inevitable troubles incidental to all South American journeys. Of my two arrieros contracted to manage the mules, one, on hearing of the savages below, bolted with my best animal, and the other shammed sickness, got it "all over him," as he described the malady (having pecuniary guarantees in La Paz which prohibited flight), so I got rid of him.

The Inca Mining Company's road crosses the Cordilleras by the Aricoma pass, 15,088 feet above sea-level, and drops down the gorge of the Limbani river to meet the Inambari at Oroya. Crossing and recrossing the torrential Limbani by flimsy-looking wire rope bridges, and hollowed out in part in the sheer face of mighty precipices, it is a most picturesque road, and by far the best mountain trail in the country. From the Inambari it rises sharply to the famous Santo Domingo mine, crosses a lofty ridge, and drops gradually to the Tambopata at the port of Astillero. The section of the road taken by a Richard barograph gives a good idea of the abrupt fall from the Altiplanicie to the forests.

One can appreciate the difficulties of the Spanish pioneers who brought their animals over the passes by narrow Inca trails designed only for Indians on foot. Below 10,000 feet is a region of mountain torrents and precipitous hills covered by dense, and to a great extent sodden, forest of shallow-rooted and moss-covered trees heavy with orchids—a region of apparently perpetual humidity and singularly barren of bird and animal life. In the hills of Santo Domingo rain is recorded for 360 days in the year; the forest-clad hills being scarred by the constant slips of decomposed rock. This nature of country extends well into the Caupolican—razor-backed ridges with precipitous sides covered by dense and rank vegetation. Short of cutting or constructing roads, it is impassable, owing to the difficulties of movement and the certainty of starvation. To Apolo, in the Caupolican, and to the banks of the Tambopata, tracks, originally made by the Incas, have long been in existence; but any forest trail, however carefully made, is either swept away by the torrential rains or eaten up by the forest without constant attention. Future transandine railway tracks will have the same trouble.

The country is rich in gold throughout, from the Apurimac to the southern extremity of Bolivia, and attracted no little attention from the Incas and their successors. In the sixties a population of over twenty

thousand Indians are said to have washed gold in the Apuroma field south of the Inambari. To-day there are a few prospectors picking at the crevices in the upper waters of the numerous creeks which empty themselves into this river.

In the basin of the lower Tambopata, 220 miles by the trail from Tirapata, one is on the outskirts of the mud and clay region of the Amazonian basin, and begins to get a taste of its winged and crawling pests. To the north and east, flat country though it appears, still extend the razor-backed outliers of the Andes, which make the country so difficult to pass. Assuming from its innocent appearance from the heights around Astillero an easy passage through the forest, I intended to cross this with animals in a line designed to strike the probable course of the Heath about three or four leagues from its confluence with the Madre de Dios, descend to the confluence, and from that point to reascend the river to its source, crossing again to the upper Tambopata, somewhere near the supposed position of the confluence of the Lanza. I originally intended to retrace my steps from this point to the Heath, and pass in about lat. 13° 30′ S. to the Madidi, coming out eventually somewhere in the neighbourhood of San Jose, but unexpected delays in completing the *personnel* of the expedition made it too late in the season. For the heavy rains and local inundations of November to March render all cross-country travelling impracticable or very risky.

We reached the Tambopata in heavy rain, which should have ceased in May in favour of the spasmodic bursts which signal all lunar changes in this part of the world, and it was ten days before the river, which was raging in heavy flood, permitted the passage of the animals. We started on foot with eight well-loaded mules, a plentiful store of dried and compressed provisions being sent by water to meet us at the confluence of the Heath. The Inca Rubber Company had cut about two leagues of track in a north-easterly direction into the forest, of which I took advantage. At least, I meant to take advantage of it; for there were frequent small bogs and several primitive bridges, and every mule persistently stuck in every bog and fell through every bridge with results disastrous to patience and equipment. In ten days we succeeded in cutting a circuitous track through about 15 miles of abominable country. But the bulk of my party were not accustomed to the hard work of cutting forest—for we had, it must be remembered, no peons or Indians—nor were they accustomed to mules with which they persistently got into difficulties; and as one or other of these duties fell to the lot of every one, it was very soon clear that we should never arrive at the Madre de Dios before provisions ran out. I therefore decided to return to Astillero, abandon the animals, and perform the journey as far as possible by boat, which, although easier, had the disadvantage in the Heath of being more vulnerable to attack by the savages, assuming that the latter were hostile.

This piece of forest work had the merits of giving my party some

practical experience, if only of insects, which in places fairly swarm over one in their search for salt; while cutting paths in forest where wasps and poisonous ants abound inevitably means trouble. All of us were bitten, for instance, more than once by that very poisonous black ant, over an inch long, known as the "tucandera." Moreover, we suffered from torrents of rain. No one was therefore loth to return to Astillero, despite the unpleasant feeling of turning back. On August 11, I secured a boat to take us down to the Madre de Dios. This latter river and its tributaries are being populated by Peru with a view to effective occupation of the land; although this artificial population is scarcely likely to be permanent without railways to facilitate transport and create markets. Moreover, the Inca Mining Company's road, which practically forms the only means of communication with outside Peru, will rapidly vanish if that company ceases operations. I stopped a day or two at Maldonado to exchange compliments with the Peruvian authorities at that post, and then passed on to the mouth of the Heath, where there is a small Bolivian detachment. The Madre de Dios here has an average width of 450 yards, and the Heath enters the river an insignificant and turbid stream only 45 yards wide.

From this point I had three small canoes and a plentiful supply of provisions; for, as I have said before, there need be no scarcity in this respect as long as some form of navigation is possible. The Heath loses its insignificant character a few miles from the confluence, when it develops into a fine but tortuous river some 80 yards wide, with huge sandbanks at every turn, and with banks of mud 12 to 20 feet above the low-water level, topped by heavy but singularly clean forest. In the lower river are rapids formed by blocks of hard-baked mud and river conglomerate, common throughout the upper Amazon basin at low-water periods; while the accumulation of snags makes navigation somewhat difficult at this season. The river was sufficiently shallow to allow of poling the canoes, a much more rapid method than paddling against a strong current. Hours of work were from seven to five, with an occasional short spell of a few minutes, time being an element of great importance, and a midday meal being undesirable owing to the flies; "mariguis" and "tabanas" being very numerous. The party had of course, to accustom itself to the work, involuntary baths being frequent.

Fifty miles from the confluence we encountered the savages. Leigh, Costin, and myself were some distance ahead in the leading canoe, the other having fallen behind owing to the difficulties of threading the labyrinth of snags. On rounding a turn on the river we saw, about a quarter of a mile ahead, a collection of newly made palm huts on the point of a large sandbank, and at the same moment heard an uproar of barking dogs, shouting men, and screaming women and children, emphatic testimony to their appreciation of their civilized neighbours. We immediately endeavoured to reach the huts before they had disappeared. Opposite to the sandbank, on the other side of the river, which narrows at this point to about 30

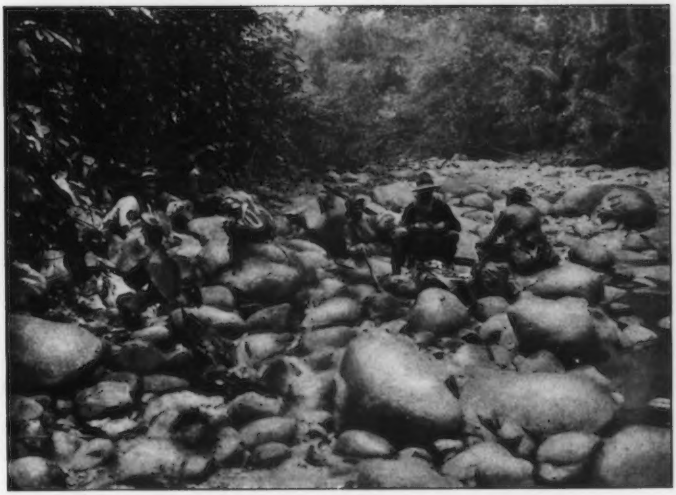
yards in the dry season, was a red earth cliff cut out by the river, and some 20 to 30 feet in height, extending the whole length of the sandbank. Against this cliff and on the sand were tied up fifteen large canoes and various rafts known as balsas. With South American savages it is foolish to show any hesitation ; so passing directly under the high bank, we landed opposite the huts. There was not a sign of a savage, only barking dogs, two or three parrots, and a monkey tied to a pole. As the second canoe came up, however, an arrow struck it, passing completely through about an inch and a quarter of wood, succeeded immediately by more arrows and by fire from shot-guns, which latter had probably been stolen at different times from the rubber pickers on the Madre de Dios and Tambopata. How some one was not hit it is difficult to understand.

One of the party—it was not one of the three non-commissioned officers I have mentioned—embarrassed matters by throwing himself in a panic into the water behind a canoe and trying to bury his head, ostrich-like, in the sand, only emerging as the canoe was pulled ashore to pray me to retreat. I had previously given orders that under no circumstances was a shot to be fired, but it was not easy to restrain some nervous members of the party. Reprisals were of course out of the question except as a last resource, for any shooting would have been the death-warrant of the lot, as I have no doubt it has been before in similar cases. Trusting in the proverbial influence of music, I told Todd to strike up a tune on the accordion, which, although considered under some circumstances a somewhat deadly instrument, must have been a new experience to savages. The rain of arrows, however, did not abate. As I remarked before, I do not know how the party escaped, but I assume that from under cover at sixty yards, and with the expectation of a bullet, the savage is not a deadly shot. A monkey belonging to themselves and tied to a post in the middle of us was struck by no less than seven buck shot, and, needless to say, killed ; while the sandbank itself presented the appearance of a plantation of arrows, each of which was some 7 or 8 feet in length. These arrows have a long barbed point of heavy wood, followed by a light cane shaft on which the feathers are set spirally, acting in a similar manner to rifling and preserving the straight flight otherwise impossible for so long a weapon. Their penetration is tremendous. I have heard of the case of an Englishman in the upper Paraguay, where the arrows are similar, being pinned to the deck of a launch transversely through both arms and his chest. In order to show some intention not to molest the tribe, the canoes were dragged one by one, under short-range fire from their position in front of the huts to a far corner of the sandbank. The attack, however, persisted for about an hour and a half, and was rather serious, as the escapes, again and again, were exceedingly narrow, and a party of the savages had gathered in our rear. Wherefore, with one eye on the look-out for arrows, and the other on a little vocabulary of Guarayo words secured in the Tambopata, it became

necessary for me to enter the river, and at close range endeavour to conciliate the enemy. I do not recommend it as at all inviting to search a book for suitable words in an unknown guttural language with the whizz of arrows about one's ears and at a range of some 25 yards from savages who are supposed to be experts at the game. However, Providence has been gracious to us on all these expeditions. Two savages at last showed themselves, and, as my pronunciation of the language appeared to be at fault, I signed to them that I would come across. The river proved too deep to wade, and the savages signalling to me to take one of their canoes, I called up Gibbs, and between us we launched a heavy dug-out and shoved across the stream. To cut the story short, they gave us a hand up some footholds in the cliff face, on the top of which we were received by some thirty savages, accompanied them into the forest, interviewed the chief with the aid of the book, and, very much to the relief of the rest of the party, returned in about half an hour to the bank with the chief's son wearing my hat, and all of us the best of friends.

Ten savages came across the river with me, and having collected their plantation of arrows, helped us to make camp, remaining in it all night and giving us yuka, bananas, fish necklaces, parrots, and in fact of all they had, including a red vegetable paint named "uruku," or "sepai," which made the insect bites more or less innocuous while it lasted, and for which we were not a little grateful. Such was the first and only encounter with the dreaded Guarayos.

In this village I estimated at least one hundred and fifty savages. The women and children remained in the forest, and did not return whilst we were there. The men are finely developed, and of a warm brown, black-haired, good looking and well clothed in dyed cotton shirts, plenty of which were in course of manufacture in their huts. Their skin is exceedingly coarse, and a mass of little lumps, due to the bites of "mariguis" and "tabanas," to which no amount of custom seems to render them immune. They struck one as a most intelligent race of people, whose services it seems a vast pity not to have used in a country where labour is so scarce. They appear a healthy race, and sanitarily are far and away ahead of the so-called civilized Indian outside. These Guarayos who were formerly reputed to have been cannibals, are supposed to have originally come from Brazil, and their language is said to be akin to the Guarani of Northern Paraguay, and Southern Matto Grosso. There was, of course, no opportunity for studying their customs. Moreover, we expected to meet plenty more of them further upstream. From the little that is known of them, all religious ceremony and beliefs are kept rigidly excluded from the women; the men are monogamic excepting the chief, who usually has eight to twelve wives; and all men too old to work in the plantations or women too old to bear children, are killed, or commit suicide—a custom due probably to scarcity of food supplies throughout these regions. Such a thing as an old man or woman does not exist, as far as I know, in the whole



IN THE UPPER HEATH.

MIDDLE HEATH, SHOWING HIGH-WATER LEVEL OF RIVER.

GUARAYOS, HEATH RIVER.

ROCK PATH ON THE INCA MINING COMPANY ROAD.

interior Amazonian basin. The Guarayos live in family groups or small tribes up to about two hundred in number, each tribe having its territorial limits and its own plantations. Infringement of boundaries means intertribal war, practically a perennial condition amongst the tribes. In these days I doubt if the Guarayos use poisoned arrows; but, as no one was hit, it is hard to say. According to the chronicles of the ancient missions, they were peculiarly dexterous in the composition of deadly poisons. They use, at any rate, the milk of the "manuna," or "soliman" tree, the scientific name of which is, I think, *Hura crepitans*, of the Euphorbia genus, for catching fish.

The morning after the encounter I went with some of the Indians to a lagoon in the forest. Here, floating on the surface of the water perfectly alive and yet absolutely unable to get away, were fish of all kinds big and small, from which they selected the most palatable for food. The milk is merely poured into the water, and as it spreads every fish which comes into contact with it becomes paralyzed, and yet is not affected as food. Moreover, the effect appears to last for several days without killing the fish. The milk is also used as a cure for toothache, as a caustic, and for the purpose of suicide, for which a teaspoonful is employed. As a poison they say the results are painful. The constitution of the sap is well known.

This meeting and its fortunate sequel led to a friendly attitude of the Indians throughout the river. For many of the Indians left their camp for upstream, and we were not molested by Guarayos again throughout the river, although there was evidence of an extensive population.

This did not relieve us, however, from night watches, or constant vigilance. On several occasions at night, voices were heard of reconnoitring savages, nor was the party ever free from the possibility of a sudden attack. In one place a quantity of large canoes were drawn up clear of the water, and many others moored at various points in the river, whilst almost every sandbank had its huts, all constructed since May. At almost every turn of the river exist large plantations of bananas or maize. In the wet season the Indians are supposed to live some distance away from the river in large huts of more substantial construction. They have dogs, fowls, monkeys, and tame parrots in abundance. Two Indians accompanied us up the river for three days with the idea of assuring a friendly reception by other Guarayos, but on the third day improved their opportunities to decamp, carrying with them a rifle and bag of ammunition.

The work of ascending the upper river was very hard, particularly when the region of stones was reached, and more rapids were encountered, involving constant wading. The heavy rain incidental to every change of the moon in the Amazon basin, a blazing sun, the plague of poisonous flies from morning to night, and hauling heavy canoes through rapids over a river-bed of very slippery stones, are trying to the strongest. Constant wet and sand, or perhaps some microbe peculiar to the water, pitted the soles

of our feet and skinned the legs and between the toes in such a way as to make walking exceedingly painful. Boots which were not wire sewn came to pieces. Moreover, it must be remembered that we anticipated a shower of arrows at any turn of the river, and that constant vigilance and night watching kept the nerves of the party at tension. In lat. 13° 35′ S. we entered hills, not, I think, a little glad of the change from the monotony of flat forest. Up to this point the river must be readily navigable in the wet season by launches, as it rises 9 to 12 feet above low-water level, and clearly floods the surrounding forest in places. It is navigable with patience at any season by canoes, and the current is easy. In the upper river, however, boulders and rapids make navigation difficult. We pulled the heavy canoes over no less than a hundred and twenty rapids, some of them long and formidable, in five days. This it was necessary to do partly because the transport of food and instruments is so much easier by boats, and partly because it was impossible to anticipate a continuation of rapids to the source. The Verde, for instance, which we explored in 1908, had an extended stretch of easily navigable water above a long series of rapids.

In 13° 39′ S. we encountered another tribe of savages similar to those met with in the river Tambopata and wrongly known there as Guarayos, from whom they essentially differ. It was in their language that I had tried to conciliate the people below, though the two races have many words in common.

They made for Leigh and myself, who were well ahead of the others, apparently with the intention of attacking, but fled on the appearance of the second canoe. However, I chased them, and with some difficulty induced two of them to believe that we were friendly. After liberal presents of knives and sugar they left for their camp, returning later with the whole tribe, numbering only a score of men. The men wore shirts of bark, and the women nothing. The whole tribe, which belonged to the Echojas or Tiatinaguas of the Tambopata, generically better known as Chunchos, have a similar backward and dirty appearance. They were evidently afraid of the Guarayos below.

The names of these tribes are very confusing and difficult to identify with existing records, from the custom in each small tribe of adopting the name of its temporary chief. The name Guarayo, for instance, is quite unknown to the savages themselves, who call themselves "Quinaqui," and other names. It is more than possible that it was given to them by the early explorers of the Caupolican, who adopted the word with which the savages first accost a stranger in the form of interrogation, namely, "guanayo?" or "guarayo?" meaning throughout all the tribes, "enemy?"

I knew that we could not be very far from the Tambopata river, so was not surprised to learn from the savages that it was close by. But what did surprise me was that a short distance above this point the rubber-

pickers of the upper Tambopata had been tapping trees in the Heath, ignorant, so I discovered later, of what river they had struck. The Heath, in fact, bends to within two leagues of the upper Tambopata, in 13° 40′ S. From this latitude to its confluence with the Madre de Dios it is very rich in rubber. With easy navigation and an outlet by the rapidly completing Madera and Mamore railway, which is being extended to Riberalta in the Beni, it only requires judicious management of the Guarayos to ensure a most lucrative business. In fish and game the river is most plentifully supplied. The fish, in fact, give excellent sport, particularly the "sabalo," approaching the salmon in appearance and almost as good to eat, and which is most prolific. Troops of pig haunt the river-bank; the "anta" or tapir is ubiquitous; and a short excursion into the forest will always produce a bag in the lower river. This river and the Madidi and the intermediate country have no doubt been selected by the most powerful tribe as the garden of the Caupolican.

In the upper waters south of 13° 40′ its character changes. It emerges from a labyrinth of hills practically impassable across country near the source, and whose sides, covered with rank vegetation and rotten trees, bearded with moss and dripping from perpetual rain, rise precipitously some 1200 feet above the river and make as gloomy surroundings as the lower river is cheerful. In what virtually are gorges, a quantity of torrential streams hurl themselves over rugged boulders down a 10-per-cent. gradient to form the Heath.

The ascent of these streams is most difficult. From navigation end it was necessary to carry everything on the back, progress over large and slippery stones with raw feet, and later sheer rock climbing over huge boulders or creeping along ledges of greasy slate with fifty or sixty pounds on the back, a rifle in the hand, and a 20-foot drop on to rocks below, being anything but a pleasant experience to look back upon. There were, indeed, constant and serious falls. The undergrowth was far too dense and obstructed by boulders to permit of threading a way through the forest edge. Scarcity of food supplies necessitated a single meal daily; it rained all day and most of the night; and no wood could be induced to burn. Of game or fish there was none. Captain Vargas Bozo, our Bolivian companion, broke down completely in lat. 13° 40′, and had to be left behind to make his best way westward to the Tambopata in order to save his life. I learnt afterwards that he lost his compass and then himself, and if the much-abused savages whom we left friendly had not discovered him he certainly would never have got out. But for the inexhaustible energies of Leigh and Todd, the rest of the party would have suffered a good deal more. As it was, three of them broke down and could carry nothing beyond their bare kit.

It would be difficult to speak too highly of Leigh, who was a cheerful and splendid worker throughout. Unfortunately, his doctor will not allow him to go out again.

Owing to the persistent rain in the upper river, it was impossible to take astronomical observations. The position of the source is therefore dependent upon the compass and dead reckoning.

From the source I was forced to retrace my steps to lat. 13° 39′, in order to cross to the Tambopata, which we struck at a small post called Marte, within two leagues of the Heath.

Geologically, the predominating feature of the upper Heath is slate, alternating with contorted beds of granite and quartzite, and occasional sandstone. With the granite and quartzite frequently occur shallow beds of red and blue clays. This blue clay occasionally occurs as a conglomerate with small rounded pebbles of quartz, and might possibly repay a prospect for diamonds, of which there are rumours in a similar formation in the Madre de Dios. The slate, which is probably a continuation of the same formation which occurs at Sto. Domingo on the Inca Mining Company's road, carries veins of quartz which may be gold bearing in places; but I had no means of making any efficient prospect.

Butterflies are magnificent, and insects generally troublesome throughout the river, particularly the "pium" or "marigui," every one of whose myriads leaves its itchy blood-blister. The water in the upper river is remarkably clear and most prolific of fish, amongst which is a very small bellicose variety to which we attributed mysterious stings while bathing, and another which skims along the surface on its tail in the manner of the familiar gar fish, and both of which are, I fancy, peculiar to this river. The sting ray is plentiful throughout, and the "kanderu," that unpleasant little fish with a predilection for getting into the interior economy, infests the lower river. Snakes, poisonous and other, are very numerous both in the rivers and on the banks.

The usual accompaniment of venomous ants, poisonous flies, ticks, etc., is, of course, present in the forest, and through the entire Caupolican precautions have to be taken against the vampire bat. Four of us were bitten by this pest on the same night. The soft whirring of its wings over the head prior to biting has a curiously soporific effect. One feels absolutely nothing. I awoke one morning to find the upper end of my hammock saturated with blood. There are no recognizable ill effects; but in some parts of the civilized Caupolican it is impossible to keep cattle, and in the upper Tambopata the Indian rubber-pickers suffer from a species of anæmia attributed to the repeated attacks of this pest. Mules and horses are almost invariably bitten on the withers, the bite in a couple of days swarming with maggots if not attended to. The region of the upper Tambopata is specially victimized by that delightful insect known as the "boro" or "sututu," which lays eggs under the human skin to ripen to maggots. Scarcely any one escapes these attentions. There are three culprits, a moth, a tabana, or species of large house-fly, and a mosquito, the maggots of which take some days to develop, and vary from the size of a pin's head to that of a large chrysalis. The maggots grip and eat

their way into the flesh and are very painful, only being extracted by previously intoxicating the occupant with tobacco juice or some strong antiseptic.

We were fortunate in reaching the Tambopata at Marte, where we found Captain Vargas Bozo, and passed slowly, after a day's rest, to San Carlos, a rubber station about 40 miles up river. Here I left the party to recover, with the exception of Leigh, who accompanied me to search for the Lanza, whose confluence with the Tambopata it was necessary to determine accurately. The position was found considerably at variance with previous reports; indeed, the geographical data of the whole of this portion of the frontier compel modifications in the treaty. On September 30 the party returned to Marte, whence it was necessary to reach Astillero in the lower river. I had two occultations supporting one another to which to refer longitudes, one in the Madre de Dios and the other in the Heath; but it is always a satisfaction to link up a circle of longitudinal differences. Moreover, there was a considerable discrepancy with the Inca Mining Company's position for Astillero, and I wished to be sure that I was not in the wrong. I discovered on the way out that they had made a mistake in their calculations, which brought all my observations into line with their own; so that there is not probably any great error in the co-ordinates.

The upper Tambopata between Marte and Astillero is one 45-mile series of rapids 200 or 300 yards apart. Above Marte it is not navigable. Below it is not inhabited to Astillero, except by some small tribes of Chunchos or Echojas, who are friendly; and the navigation is confined to balsas, rafts of seven logs of a special light wood. Our Bolivian friend was unable to swim, and as it is not advisable to risk such a journey without this accomplishment, he returned to La Paz by way of Sandia and Kohata. The rest of us set out on three balsas. All the valuable cargo went with me, as I had previous experience of this class of navigation. In fact, Leigh and I reached Astillero without mishap. But the other balsas suffered repeated shipwreck, one going to pieces on a snag, and being repaired by some friendly Indians. Anything more exhilarating than the descent of roaring and tortuous rapids, the end of which cannot be seen, in a river unknown to one, can scarcely be imagined. The balsa swung down them, sometimes through a raging tumble of great waves, at a rate of 40 miles an hour. I looked back once in a rapid to see Leigh in the water behind the balsa gasping for breath and holding on by his finger-nails. He had simply tried to keep the stern off a rock in the middle of the rapid, and had shot overboard. The descent made up, however, for all the labour in the Heath. We reached Astillero on October 3, and were warmly welcomed by its incredulous population, who had so considerably prophesied and anticipated all sorts of disasters. From here in due course we took mules, and returned to La Paz on the 25th of the same month.

This exploration, the difficulties of which are scarcely appreciated by

even the Government concerned, after the event, would have been absolutely impracticable for any large force without a previous knowledge of the upper river, or for a small force of Bolivians or Peruvians, against whom the savages are especially revengeful. It all hinged upon friendly relations with the Indians, and, like all other journeys in South American forests, upon the ability to withstand the strain of very hard work coupled with shortage of food. I certainly anticipated no such easy return, nor do I think we should have had such a one if the source of the river had been more to the east of the Tambopata, or the latter river been uninhabited, as for all that we knew to the contrary it might have been. Because, although we had plenty of excellent food whilst we had canoe transport, there is a very narrow limit to the amount one can carry on one's back in addition to instruments, rifles, and the minimum of camp equipment. As it was, we ran out of food completely before reaching the Tambopata, and some of the party had not only passed the limit of carrying anything more than their hammock and rifle, but had just about reached their limit of endurance even with that light load. What is required for these explorations is a small party of loyal and very hard men. Numbers are a distinct handicap, except in so far as they save the nervous strain inevitable to a small party in hostile country.

I fail to see, after five years' experience of South American exploration, how it is possible to simplify or render less risky such work. A leader with experience and six good men can, in my opinion, go anywhere; whereas a large force can very well be lost, as they not infrequently have been. A system of depôts and unlimited expenditure might simplify matters, as in the Brazilian telegraph work in northern Matto Grosso, where, however, the loss of life has been very great; but in this case it has been necessary to condense our work into the months between May and October, when rivers are passable and local inundations do not exist. I neither have unlimited funds nor do I want them. Moreover, the Government, with very good reason, wishes the work done quickly and economically. After all, exploration is a very different matter from the leisurely survey which follows, when the party knows exactly where it is going and what it is up against.

This mapping of the river Heath winds up the frontier exploration of Bolivia, whose delimitation should be completed next year.

However, I hope this year to have the opportunity of crossing from the Heath to the Madidi, somewhere about the latitude of 13° 35′, and seeing more of the Guarayos, and possibly old Incan ruins.

The Bolivian Government has, I may say, given me throughout every facility for which I have asked, and has denied me nothing. I owe also a debt of gratitude to my friend Colonel Don Pedro Suarez, the Bolivian Consul-General in London, whose interest and sympathy have been as unfailing as they have been invaluable. I have been limited only by the natural difficulties of the country. In this year's

work we had, too, the cordial co-operation of the Peruvian Government, whose local governors were most courteous and hospitable so far as their abilities extend. There is every hope that the delimitation, which on the part of Peru is in the hands of British officers, will be conducted on equally cordial terms, which will go far to cement the friendly relations of two rich countries of identical interests. The benefits are likely to be appreciated at no distant date, for although the increasing production of gold is for many reasons to be deprecated, and is responsible for many troublesome social problems, it seems to me certain that, when or perhaps before the Panama canal is opened, there will be a boom on the rich gold belts of southern Peru and all Bolivia east of the Andean Cordilleras. The mineral wealth of these regions it is difficult to exaggerate. Gold is everywhere. Immense masses of auriferous quartz can be encountered throughout the Andes running, perhaps, one-half to one and a half ounces to the ton, while the gold-bearing slates to the east which at Sto. Domingo have reached eighty ounces to the ton, persist throughout southern Peru and Bolivia. These formations have been denuded for hundreds of thousands of years either into the old glacial moraines of the western heights or washed into the old river-beds and existing torrents of the abrupt eastern slopes. None of these have been more than scratched at. A great gold district extends over 400 square leagues in the neighbourhood of Sta Cruz, and pushes out like a wedge into south-western Brazil. Remains of primitive washings and quartz workings of the Jesuits, abandoned on their expulsion, fairly litter the country. In southern Bolivia exists also what is probably the richest tin region in the world, the vast bulk of it unworked yet for the want of capital and difficulty of transport. I am not going into more details, for it is only repeating what I said in my paper of 1910. I only urge upon public attention the great awakening which is taking place on the Pacific side of the continent, and which will be accentuated on the completion of the canal, affording a unique opportunity for enterprise. In Bolivia, at any rate, facilities will shortly exist for all mining ventures east of the Andes, as well as for other lucrative enterprises by the establishment of the transandine railway from La Paz to the Beni, which is the finest railway proposition to-day in South America.

Regarding further exploration, when the less exacting frontier delimitation has been completed this year, as it should be, I propose to traverse the unexplored portion of the Caupolican, a scheme encouraged by the Government, and almost certain to have interesting results. There will probably be only three of us, and I intend to risk the wet season in order to carry it through.

It may be as well to say that, though there is much to map or map accurately throughout South America, the areas which can properly be called unexplored are confined to certain parts of western Brazil, certain restricted corners of Bolivia and of the hinterland of Colombia, the latter of which, however, I am not quite sure about.

Elsewhere, in Peru for instance, in the hinterland of Venezuela, and in Brazil, the rubber hunter and the gold prospector have between them penetrated pretty well every corner, and there are at least no mysteries. South of lat. 15° S., that is, in the open scrub and grass country to the south of the big forests of the Amazon basin, the geography is fairly well known, although there is still a hazy idea about some corners of the Bolivian Chaco and northern Paraguay. In all these places the savage has had trade relations with the white man, and may be visited with discretion and discomfort; and, as a rule, boats or the useful mule will simplify transport.

But in those portions of the forest regions of Brazil between the main rivers and up in the unknown whereabouts of their sources, or in the veritably unexplored parts of Bolivia, it is quite another problem. Experience is essential, and even with it the traveller must risk a good deal. Certain parts of western Brazil are probably impossible to penetrate without a considerable armed force, the financing, transport, and feeding of which offer serious difficulties, unless the explorer likes to risk my small party theory and peaceful tactics. In Bolivia there is still the interior of the Caupolican unknown, and the eastern centre between the Mamore and Guapore in the region of the S. Simon hills, which, if once partially known, needs re-exploration.

For reasons which may now be better appreciated, there is not to-day one single genuine exploration party in the forests of tropical South America south of the equator, nor have I heard of any expedition independent of boats and mules. It is an absolute fact that in the region of the upper waters of the Amazonian tributaries, east of the Andean slopes and away from rubber concessions and highways of trade, nothing is known of the great mass of the country a hundred yards from the river-banks.

I hinted last year at the romances which may await the explorer if he will leave the rivers and get away from the rubber districts into the more remote forests. They were not exaggerated. There are strange beasts and weird insects for the naturalist, and reason, at any rate, for not condemning as a myth the existence of the mysterious white Indian. There are rumours of forest pigmies and old ruins. Of the Amazonian aborigines there are plenty of theories, and little of fact. Nearer civilization there are lost mines.

I could tickle the appetite of the romantic with more, but it is not sufficiently definite to warrant courting a reputation for travellers' tales from the incredulous folk who sit at home and think they know all that is to be known about the world. What I hope is that the publicity of these explorations may attract other adventurous spirits into this neglected part of the world. But it should be remembered that the difficulties are great and the tale of disasters a long one; for the few remaining unknown corners of the world exact a price for their secrets. Without any desire whatever for

self-glorification, I can vouch for it that it requires a great enthusiasm to successfully bridge, year after year, the wide gulf which lies between the comforts of civilization and the very real risks and penalties which dog every footstep in the unexplored forests of this still little-known continent.

The PRESIDENT (before the lecture): Major Fawcett, who is going to lecture to us to-night, addressed us less than a year ago in this hall, and therefore it is necessary to say very few words in introducing him. In the year 1906 he went out to Bolivia in connection with the Boundary Commission demarcating the boundary between Bolivia and Brazil, and he went through a country practically unknown, suffering great hardships. His present expedition—the one he has undertaken since this time last year—is in connection with the boundary between Bolivia and Peru, and he has also traversed regions which have never before been visited by Europeans, and has again met with considerable difficulty and considerable danger. The river he ascended has never before been ascended by any one, and is new ground.

Colonel PEDRO SUAREZ: I must commence by thanking Major Fawcett for the very interesting paper he has just given to us on his recent explorations in my country. I must tell you that it is owing to Major Fawcett's bravery that this has been accomplished, because I know, from persons who have informed me, how he crossed the river in front of a whole tribe of hostile savages, and simply by his bravery induced them to cease firing, and accompanied them to their village. I must say they are indeed very hostile, because I have been among them myself, and in 1893 General Pando not only lost some of his men, but also lost his nephew, and the engineer, Mr. Muller, who, tired of the journey, decided to cross from one of the rivers up to the Modeidi, and up to this day we have not heard anything about them. In fact, an expedition that was sent a year or two afterwards discovered in the savage village the empty cartridges of the revolvers, which undoubtedly showed that they had defended themselves against the savages. About the insects that Major Fawcett has just told you, I can vouch for those myself, because unfortunately I had a few in my arm on one occasion, and I did not quite understand what they were until some Indians pulled them out from my arm. Bolivia owes a great deal to Major Fawcett and the three non-commissioned officers who accompanied him, because they have indeed discovered an unknown part of the Heath, as General Pando and some of the others have not gone quite up. Major Fawcett has done more work in that part of South America than all the other men who have gone on explorations. If we had a few more men like him, I am sure there would not be a single corner of the unexplored regions of Brazil or Bolivia that would remain long without being known to everybody. I have to thank Major Fawcett once more for the interesting paper, and I wish him great success this year, as he is returning early next month to join the Bolivian Commission, which will meet on April 1.

M. EDUARDO LEMBCKE: As a result of the treaty about the delimitation of Peru and Bolivia, my Government has asked the British Government to lend them some officers to undertake the task on our side. This is the result of the good work done already by Major Fawcett and his companions for Bolivia. I feel sure that both Commissions, working in harmony, will be able to bring this boundary question to a satisfactory end. What Major Fawcett has told us to-night about the interesting features in Bolivia will certainly be enlarged much more when these two commissions have completed their work there, and I can

only say that when the delimitation is finished we shall have another very interesting evening here, listening to the gallant officers to whom this delicate piece of work has been entrusted by both Governments respectively.

The PRESIDENT: Those ladies and gentlemen who often attend our meetings know how easy it is for me, as a rule, to call on a number of gentlemen who are acquainted with the part of the world being described, and it is a tribute to the solitary and unknown region which we have heard discussed to-night that there is not, I believe, a single person in this hall who has ever been anywhere near this part of the world. There are, it is true, the three non-commissioned officers who accompanied Major Fawcett, whose names, I know, he wishes always to have coupled with his in connection with this arduous exploration. The main exploration accomplished by Major Fawcett on this occasion was the ascent for the first time of the Heath river. If you look at his map which he gave us this time last year you will see that the Heath river is fairly accurately drawn, and possibly in time it may be said that that accuracy indicated that the course of that river was known beforehand. It was, however, merely a clever anticipation of Major Fawcett that enabled him to draw that river on the map. Major Fawcett, you will observe, travelled nearly the whole of his time along the banks of rivers. But we are glad to hear from him that he intends to go right across the country next time. It will be an arduous expedition, but it will be well worth undertaking, and we wish Major Fawcett the best good luck in his endeavour to accomplish the feat. I think we must all be thankful to Bolivia in that it still affords one of the few places in the world where the explorer can go forth and exhibit perseverance, energy, courage, forethought, and all those qualities which go to make up the qualities of an explorer of the times now passing away. Major Fawcett has shown all these qualities, and also another, the one I like to dwell on most. I allude to the way in which he was able, by peaceful dealing with the savages, to win his way amongst them without having to fire a single shot.

Major FAWCETT: I should like to thank Your Excellencies and Major Darwin for your kindly allusions to the work, both on my own account and on behalf of my companions. I am sure that as long as we can uphold British prestige, benefit the country for which we are working, and also add something to geographical knowledge, we shall not grumble at the difficulties and the insects. I thank you very much for your attention.

HANNIBAL ONCE MORE.*

By DOUGLAS W. FRESHFIELD.

"THERE are subjects of no earthly importance to any one and of interest only to a very small portion of society, which have still, within those limits, been discussed with greater zeal than matters of a much higher and more useful description. Of this nature is the passage of Hannibal over the Alps." So wrote, in 1830, "a member of the University of Cambridge" in an endeavour to confute Wickham and Cramer's Dissertation on the same even then well-worn subject. The last eighty years

* 'Hannibal's March through the Alps.' By Spenser Wilkinson, Chichele Professor of Military History. With two figures and four maps. Oxford: The Clarendon Press. 1911. 48 pages. 7*s.* 6*d. net.*

have been fruitful, not only in this country but also in France and Germany (Italy for some reason seems less interested), in attempts to solve the old puzzle, attempts in which the better knowledge of the Western Alps attained in the course of the last half-century has naturally been brought into play. The most recent of these essays is now before us, a slender but not inexpensive volume of forty-eight pages, from the pen of the Professor of Military History at Oxford.

Prof. Wilkinson has been little harassed by the vagueness, or the apparent discrepancies, in the narratives of Polybius and Livy that have exercised the ingenuity of his predecessors. For he has found a key to the puzzle which fully satisfies him in the two picturesque passages in the classical authors in which each purports to give an abstract of a speech supposed to have been made to his soldiers by Hannibal on reaching the crest of the Alps. It may be convenient to bring back to the minds of our readers the passages in question. Polybius must come first:—

"Hannibal, seeing his men discouraged both on account of the hardships already undergone and those they anticipated, called them together and strove to encourage them, having one ground for this, the prospect (ἐνάργειαν) of Italy. For it lies so close under the aforesaid mountains that to those who contemplate both in one view the Alps appear to bear the relation of an Akropolis to the whole of Italy. Wherefore, pointing out to his men the plains about the Po, and reminding them of the general friendliness of the Gauls who inhabited them, and at the same time indicating the position of Rome itself, he to a certain extent raised their spirits."

So far Polybius. Let us now take up Livy.

"Hannibal, having advanced the standards to a promontory whence there was a view far and wide, and ordered the soldiers to halt, points out Italy and the plains about the Po lying under the Alpine range, (telling them) 'they were surmounting not only the walls of Italy, but those of Rome itself, that the rest would all be level or downhill, that by one or at the most two battles they would become the possessors and masters of the citadel and head of Italy.'"

These passages Prof. Wilkinson takes "to the foot of the letter." On the strength of them he asserts that the prime and indispensable requisite for the Pass of Hannibal is that it should command from its summit a wide view of the Piedmontese plain. As a consequence, he rules "unconditionally" out of the running all the old favourites, the better-known historical passes. A French officer, Colonel Perrin, had, in 1884, pointed out that there is such a view from the Col de Clapier,* a bye-pass 8173 feet above sea-level, a few miles south of the Mont Cenis. Prof. Wilkinson has visited more than once the pass in question and finds in it all he requires. He writes: "The nature of the view from the Col du Clapier is

* Col *du* Clapier commonly; but Col *de* Clapier in recent French Government maps and 'Alpine Guide.'

the crucial evidence that this was Hannibal's Pass, and, what is even more important, that neither Polybius nor Livy draws on his imagination for his statements."

It would seem as if Prof. Wilkinson had felt no misgivings either as to the verbal accuracy of the anonymous reporter, or as to the channels through which the words alleged to have been used by Hannibal may have reached Polybius, and through him, probably, Livy. Further, it has been pointed out by competent writers that, even taking the speech as authentic, the words in Livy (which Prof. Wilkinson leaves out), "the rest would be level or downhill," may in themselves suggest to an ordinary mind a sufficient reason for such a speech. To any born leader of men the downward slope of path and stream would surely hint the occasion for making an obvious appeal to the imagination of his followers. None of these considerations, however, have troubled the Professor of Military History; he "assumes the Clapier to be the pass," and proceeds "to find the route by which Hannibal reached it."

Polybius and Livy tell us that Hannibal crossed the Rhône nearly four days' march from the sea, and four days' march (for cavalry and elephants) below the confluence of the Rhône and a river called in the generally received texts the Ἰσάρας and Isara.* The distance from the eastern mouth of the Rhône, where Scipio was encamped, to the meeting of the Rhône and the Isère is about 125 Roman miles. Roquemaure, where Hannibal has hitherto been supposed by most writers to have crossed the Rhône, is about 50 miles from the mouth and 75 miles from the confluence. In his attempt to trace the famous march Prof. Wilkinson at once parts company with his predecessors. He makes the Carthaginians cross the Rhône near Arles and below Tarascon, 30 miles only from the sea. In insisting on this divergence from the general belief he has two objects in view. The first is, to find a way to fit in Livy's description of the passage of the Durance with his own theory. Having got Hannibal to the left bank of the Rhône south of the Durance, he leads him across the latter stream, alleging that Livy has misplaced its passage and confused his narrative through mixing his authorities. By an advance of another 10 miles, some 30 only in all from the crossing of the Rhône, Hannibal is made to arrive in the Island above the Confluence, described by the classical writers. In our author's view, this is the tract enclosed on two sides by the Rhône and a streamlet, the Sorgues, well known in literature as the Fountain of Vaucluse, immortalized by Petrarch. No attempt, as far as we can discover, is made to reconcile this hypothesis with the statement of Polybius that the confluence was 600 stadia or about 75 Roman miles from the passage.

Here we must pause in following Prof. Wilkinson's route, in order to

* "Skaras" in the MSS. of Polybius. Prof. Wilkinson substitutes six variants taken from different MSS., "Ibisarar or Ibisaras, Bisarar or Bisaras, Sarar or Saras," for the received text of Livy.

point out that the reasons he alleges for abandoning the common identification of the Island will not hold good in the eyes of a traveller on the spot. He writes, "The hypothesis that the island was the Rhône valley above the Isère is inconsistent with most of the statements made by Polybius about the island. The island was especially fertile, which is not the quality of the land north of the Isère. The mountains do not, even in appearance, form the base of a triangle, of which the two rivers are the two other sides. Polybius distinctly says that the mountains forming the base of the triangle were impassable." Now let us see exactly what Polybius does say. The Island, he says, is "populous and cornbearing," the mountains at its base are "difficult of approach and access, and almost, so to speak, impassable." The country between the Rhône and the Isère is still populous and cornbearing, and it would be difficult to give a more accurate description than Polybius has done of the abrupt range above the Lac de Bourget and the track through the Grotte des Échelles before Charles Emmanuel II. of Savoy, in 1670, made a charroad.*

One more exception must be taken to our author's pleading. "There is a town," he writes, "which still bears the name of the island (Isle sur Sorgues)." But L'Isle sur Sorgues, Murray's Handbook tells us, is "*on an island* surrounded by branches of the Sorgues, whose waters, employed in irrigation, spread fertility and verdure around. This is a green oasis in the desert." The town, therefore, was not named from a surrounding district, nor is it the centre of an extensive district of the exceptionally fertile character Prof. Wilkinson would have us believe that "the Island" was. This most remarkable invention of a new Island is followed by a convenient reversal of the usual location of the subalpine tribes mentioned, and the identification of the first battlefield with the bend of the Isère some 9 miles below Grenoble. In the desire to bring this spot to the right distance from the Confluence (800 stadia) we recognize the second reason for moving the Island lower down the Rhône valley. To make this locality possible as the scene of the first encounter, Hannibal is assumed not to have crossed the Isère, but to have preferred to march up its more difficult left bank. There is nearly a mile of level between the hills and the stream on the opposite right bank at the spot indicated. For the battle at "The White Rock" a defile in the Arc valley below St. Michel de Maurienne is chosen, and three days are allowed for the march onwards from it to the Col de Clapier, an assumption very difficult to reconcile with Polybius.

When we come to the descent on the Italian side, we are told that a part of the Carthaginian army found its way down the steep zigzags of the most direct track, but that the bulk of the army led by Hannibal followed another path bearing away to the right, and,

* See 'Alpine Guide,' vol. 1, p. 191, for a description and further references.

where this was broken by a recent landslip, made a considerable circuit in order to reach a glacier lying at some distance from, and considerably above, not only any present track to the Col de Clapier, but the Col itself. Having failed in this spirited attempt, they were led back by Hannibal to the broken track, which is identified by Prof. Wilkinson with a modern path which contours the mountain-side from the Col to the chalets of Tuglia. This track runs above the tree-limit, and traverses slopes shown as bare in the military map of the frontier.*

Prof. Wilkinson, in his "several visits to the pass," has, he tells us, not yet ventured on the complete investigation of these various suggested lines of descent, which he "suspects would repay the scrutiny of an expert cragsman." Are we to infer that Hannibal's soldiers climbed where all but modern Alpine cragsmen fear to tread? In the opinion of qualified travellers who have crossed the passes in October, there is no need to drag in a glacier in order to meet the requirements of the classical narratives. Moreover, if Prof. Wilkinson's identification of the path to Tuglia as the broken track is to stand, Livy's story as to gigantic trees having been cut down and burnt to split the rocks must be dismissed. I do not, however, wish to insist too much on such details. My own view, which I have expressed more fully elsewhere, is that the difficulties in the descent occurred in two places, the first near the Pass, the second considerably lower down.†

There remains one more point in Prof. Wilkinson's itinerary on which I must comment. He assumes that "the plain of the Po in the neighbourhood of Turin was reached in three days' march from the great pass over the Alps."

"Neighbourhood" is a very elastic term; but, if it is to be taken here in its ordinary sense, I cannot think that this statement is a reasonable inference from the classical narratives. Hannibal's first camp in the

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* In *Blackwood's Magazine* for May, 1836 (vol. 39), which is in the Alpine Club Library, there is a full account of the Col de Clapier by W. Brockedon. He calls it the Col de Clairée, and says, "The pass is on the Italian side, the steepest I have ever traversed." Brockedon travelled widely in the Alps, and, besides his principal work, published in 1833, 'Journals of Excursions in the Alps: the Pennine, Graian, Cottian, Rhetian, Lepontian and Bernese,' and in 1836 a series of articles in *Blackwood's Magazine;* he also took part in the first edition of Murray's 'Handbook.'

† I may venture to mention that when passing through Val di Stura I was interested in watching a Small Holder clearing his field of a big erratic block by an expedient very like Hannibal's. He lit a bonfire round it, and then threw liquid on it. I am not prepared to say the liquid was not *acetum*, but I believe it to have been cold water. *Acetum*—whatever it may have been—was, Pliny tells us, used in the Spanish mines. The ancient jests with regard to this incident seem therefore somewhat uncalled for: as Carlyle wrote, "Truth is better than error, were it even on Hannibal's vinegar."

Italian plain was, I believe, reached on the fourth and not on the third day from the Alpine crest. How else are the fifteen days in the Alps to be made up? But let this pass; it is a detail of minor importance. What I desire to call attention to is that the story of what happened at the first camp is quite inconsistent with its having been pitched in the heart of a hostile country and close to the enemy's principal town. Hannibal, we are told, was able to rest and recruit there his utterly exhausted soldiers free from any molestation; he found no difficulty in procuring provisions for his men and sending his animals out to pasture. After he had done this (Μετὰ δὲ ταῦτα), he first entered into negotiations with the Taurini dwelling close to the mountain-side (and therefore across his line of march), and, these failing, invested and in three days stormed their chief town. The natural conclusion from this story surely is that the Carthaginian camp was at the edge of the foothills, in such a position as Borgo San Dalmazzo or Avigliana, and, though close to the frontier of the Taurini, in the territory of one of the friendly hill tribes. There is nothing in this hypothesis in the least inconsistent with the broad statement that Hannibal came down boldly on the Insubrians.

Having thus summarized the chief points in Prof. Wilkinson's version of the march, we turn to see how he treats the arguments of earlier writers. He does not deal, nor can any writer on the subject be expected to deal, with them in detail. Up to 1832 ninety-two had been counted, and the number has been largely increased since that date. But even among his more recent predecessors Prof. Wilkinson has made a very limited selection. He takes no notice of a military writer, the American Colonel Dodge, one of the latest upholders of the Little St. Bernard.* He ignores Mr. Marindin's scholarly articles in the *Classical Review* (June, 1899, and June, 1901). The German critics later than Mommsen he passes by altogether. Nor does he refer to the divergent views of Alpine experts, such as Prof. Bonney, Mr. Coolidge, and the late John Ball and H. B. George. He has concentrated his attention on the views of an eminent historian, Dr. Arnold, and of a contemporary writer in these pages and the *Alpine Journal* with a certain knowledge of the Alps.

It must be a matter for regret that before dealing with the former Prof. Wilkinson did not make acquaintance with the edition of Dr. Arnold's chapters on 'The Second Punic War,' brought out in 1886 by his grandson, the late W. T. Arnold, a scholar and a critic of sound judgment. He would have found there, in an appendix of eleven pages, a valuable comment, written in the light of modern research, on the classical texts, together with one of the fullest and most judicial summaries of the whole controversy. He might also have learnt that Colonel Perrin's hypothesis is no novelty to English writers. It is true he would not have

* 'Hannibal.' By T. A. Dodge, Brevet Lieut.-Colonel, U.S. Army. 2 vols. Boston and New York: Mifflin & Co. 1901.

procured any support for that hypothesis. W. T. Arnold wrote, "So far as I can discover, the only serious argument" (for the Col de Clapier) "is that it commands an exceptionally good view of Italy. This point, of the view of Italy, is not one of those on which it is advisable to lay stress;" and again Arnold's last words are, "I should be disposed to say that Mr. Freshfield—for I do not regard Colonel Perrin, with his Col du Clapier, as a serious rival—holds the field."

We may now without further delay pass on to Prof. Wilkinson's remarks on my argument contained in the *Alpine Journal* (vol. 11, p. 267). Here again he does not seem to be acquainted with my more recent notes on the subject (*Alpine Journal*, vol. 13, p. 28, and *Proceedings R.G.S.*, New Series, vol. 8, p. 638). In these I commented, not only on Colonel Perrin's treatise, but also on the analysis of recent Hannibalian literature contributed in 1884 to the *Berliner Philologische Wochenschrift* (vol. 4, pp. 705, 737, 769) by Prof. Schiller, in which that learned writer concludes in favour of one of the Durance passes, a view also expressed more recently by Mr. Coolidge in the 'Alpine Guide.'* Nor does Prof. Wilkinson appear to have read my original essay with any close attention. Whatever claims the Col de l'Argentière (or Col de Larche, as Prof. Wilkinson prefers to call it from the village on its French side) may possess ought to be fairly stated; any objections urged against it ought to be real ones. On either ground, Prof. Wilkinson's statements invite criticism. Various instances might be given. Two must suffice here.

Professor Wilkinson writes: "Livy says that from the Durance onwards Hannibal marched across a plain to the Alps;" and he adds, "there is no plain whatever in the upper valley of the Durance, or between it and the Alps." Livy's own words are "Campestri maximè itinere." The paraphrase given seems to me forced; "for the most part over open (or level) ground" would be nearer the Latin, and in any case the sentence must be read in connection with the immediate context, a description of the rugged character of the surrounding scenery. In fact, the road from Gap through Embrun to Guillestre is either over relatively open ground or in a valley, and there is no considerable ascent. As Mr. W. T. Arnold has pointed out, Livy's description of the landscape of the upper Durance valley is singularly faithful.

My next complaint must be a more serious one. Prof. Wilkinson has, in a matter of primary importance, committed himself to a statement which will be the more misleading to the uninformed reader since it comes from a Professor of Military History.

Prof. Wilkinson emphatically asserts that the pass of The Barricades

* 'Alpine Guide,' vol. 1, p. 106: "The Col de Clapier is mentioned by French military topographers in the eighteenth century, while Hannibal, according to a very improbable theory, and certainly the Waldenses, traversed it." Mr. Coolidge himself inclines to the Mont Genèvre.

in Val di Stura cannot, in the absence of opposition from a foe, offer any difficulty whatever to the passage of an army. He has apparently forgotten the adventures of Francis the First on this very spot in August, 1515, before the battle of Marignano—adventures which are fully recounted in the passage from Paulus Jovius's 'Historia sui temporis,' which I quoted in a footnote to the article on which Prof. Wilkinson's criticism is based. The story has been retold at length by Sismondi and Michelet, in Brockedon's 'Passes of the Alps' and in the 'Alpine Guide.' In the last-mentioned work we read: "The pass was later traversed by French and Spanish armies in 1692, 1710, and 1744. Napoleon ordered a road to be made over it bearing the proud title 'Route Impériale de l'Espagne en Italie,' and even now it is styled the road 'from Montpellier to Coni.'" In 1744 the French met with serious difficulties from fresh snow on the pass in their retreat at a period of the year (November 15) little if at all later than that of Hannibal's passage (Marquis de St. Simon, 'Histoire de la Guerre des Alpes,' cited by me in the *Alpine Journal*). Prof. Wilkinson has, I assume, like other recent travellers, bowled down the excellent high-road which now traverses the gorges of Val di Stura. Had he studied Brockedon's account of his adventures, no longer ago than the early part of the last century (1826), in 'the fearful defile called the Barricades,' he might have been better able to appreciate correctly the character of the ancient mule tracks in that valley.*

Prof. Wilkinson comments somewhat severely on the assumptions made in support of hypotheses other than his own. He has himself made not a few mistaken assumptions—sometimes under the convenient shelter of an "apparently"—as to my views. I shall not stop here to deal with them. My main object in this note is not self-defence, and I am content to refer any serious inquirer to my former articles. The problem of Hannibal's Pass is one which cannot be attacked without assumptions; but, where they deal not with opinions but with ascertainable facts, it is a reasonable requirement that they should be such as a contact with facts, local or historical, does not immediately dispose of. In my opinion, Prof. Wilkinson's assumptions not infrequently fail when submitted to this test. For example, he would fain persuade his readers that before carriage roads were made, traffic and commerce did not follow certain definite main routes across the Western Alps. This, surely, is to contradict history! From Roman times onwards the main passes of the Western Alps, other than those frequented for local purposes, or in consequence of temporary political considerations, have been the passes over which the carriage roads of the eighteenth and nineteenth centuries were subsequently constructed. It is across them that, with rare exceptions, Roman and mediæval and modern armies have marched, princes ridden, and pilgrims plodded. The passes of Brockedon are the Roman passes—the Cornice Road, the Col de l'Argentière, the Mont

* Brockedon, 'Passes of the Alps,' vol. 2, p. 68.

Genèvre, the Mont Cenis, and the Little St. Bernard. In selecting the lowest and most accessible gaps in the chain, the Romans showed their usual practical capacity, and later road-makers have had sufficient common sense to follow in their footsteps.

It would take up too much space here to examine in any detail the series of assumptions by which Prof. Wilkinson leads Hannibal to the Col de Clapier. But before leaving the subject, I would put to him this inquiry. He describes my statement that Varro's route, "Juxtà mare per Ligures," is the coast road—the Corniche—as an "assumption." Has he any alternative identification to propose; if so, what? Again, does he suggest any new representative of the Graian pass in place of the Little St. Bernard? If, as seems to most critics who know the Alps, these identifications of the first and last passes in the catalogue quoted from Varro are indisputable, can he supply any plausible grounds for rejecting the surely obvious inference that the three intermediate passes are referred to in their proper topographical order, going from south to north? This is a point on which no adequate explanation has hitherto been offered by any of the writers, who are loth to give weight to the passage in question.*

I lay down this last essay to solve the ancient riddle wholly unconvinced. The speeches put in the mouths of great men by classical writers are but unstable keystones to build round; the shifting of the Island is a bold but not a plausible expedient; the march of Francis I. across the Alps from Grenoble to Cuneo in 1515 offers in too many respects analogies † to that of Hannibal to be thus lightly disregarded. And if Prof. Wilkinson is satisfied of his own infallibility in the matter, he has been anticipated in this happy frame of mind by many of his predecessors. The adoption of a definite hypothesis as to the Pass of Hannibal seems to conduce to self-confidence! Let us pause on the brink, before we too commit ourselves. The Little St. Bernard may be put out of the question; the Durance passes, the Mont Genèvre, and the Col de l'Argentière, have our sympathy; it will require a far stronger case than Prof. Wilkinson has made out to persuade us to accept his pronouncement in favour of the Col de Clapier, even though it be given, so to speak, *ex cathedrâ*, from a University Chair. But the final discovery is not yet

* M. Terentius Varro (B.C. 116–27) was a general under Pompey, a historian, an encyclopædic writer, and Cæsar's librarian. Cicero speaks of him as "diligentissimus investigator antiquitatis," a Renaissance scholar as "veterum omnium doctissimus." For fuller references to his career and acquaintance with the Western Alps, and also for reasons in favour of identifying the Mont Genèvre as Pompey's pass, see my article, *Alpine Journal*, vol. 13, pp. 33–34.

† See *Alpine Journal*, vol. 11, p. 267, for a fairly close study of these analogies. Francis I. met with a Rock, the Rocher de St. Paul, on the Western side of the pass; he camped on the watershed; he employed three thousand pioneers in making a practicable passage through the Barricades. One writer tells us that Francis "was stimulated by the example of Hannibal's passage over the Alps." I do not press this as an argument that they both used the same pass.

made and verified. The Alpine adventures of Hannibal may still continue to amuse boys and perplex professors. Mark Twain's summary of the ancient argument has lost none of its pungency—"The researches of many antiquarians have already thrown much darkness on the subject, and it is probable, if they continue, that we shall soon know Nothing at All."

Except in a few instances, references to the works and articles quoted and criticized are wanting in Prof. Wilkinson's booklet. The sheet of maps appended leaves much to be desired: none but modern names and roads have been inserted, and railways form the most prominent feature. The scales are given in English miles and kilomètres, and not in stadia and Roman miles. Only one height is inserted, that of a peak, Mont Ciusalet, which has no connection with Hannibal's march. Yet the relative heights of the Mont Cenis (6893 feet) and the Col de Clapier (8173 feet) are not without significance in considering the probability of Hannibal, if he came up the Arc valley, having preferred the loftier and more difficult pass.

LABRADOR.*

By Dr. WILFRED T. GRENFELL, C.M.G.

In accepting the offer to lecture to the Society before I again left England, I had not expected to be required to write a treatise on Labrador, consequently I fear that the time at my disposal will not allow me to do justice to the country or myself. I must ask you to accept the following short paper with this apology appended.

I first went to Labrador in the summer of 1892, and have ever since been going to and from that country and cruising along its coasts and fjords. I have not personally spent the entire winter there, but I have been there from May to December, and I have kept trained colleagues there assisting me, while I myself wintered on the south side of the Straits of Belle Isle, that I might be in somewhat better communication with the outside world. I have cruised more than once as far north as Ungava bay, and also followed the coast from Quebec to Belle Isle in charge of my own boat as master. With the assistance of colleagues, I have had the advantage of studying various features of the physiography that call for training not included in the curriculum of a surgeon. During two summers I was honoured by the collaboration of Sir William Macgregor, late Governor of our colony, and well known as an expert surveyor. I have not myself been ever more than a day's journey from the coast-line into the interior, but I have arranged and assisted expeditions that have done so. These are some of the sources of information on which my

* Royal Geographical Society, February 27, 1911. Map, p. 476.

deductions are based. Mrs. Hubbard, Dillon Wallace, Hesketh Prichard, William Cabot, have all written on the interior.

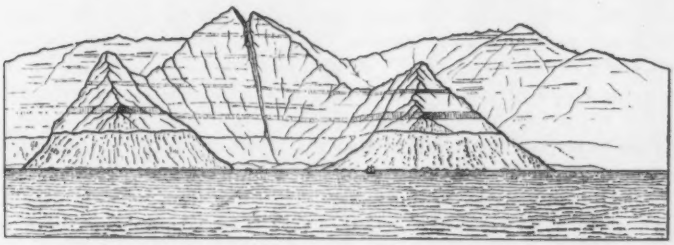
Labrador is between the same parallels of latitude as Great Britain. It has an area of 450,000 square miles, and is the nearest of her trans-Atlantic children. It might naturally, therefore, be expected that she would have received the lion's share of her mother's attention. This, however, is entirely the reverse of the facts, and that for these reasons. Firstly, because the polar current places her coast-line on an isothermic level with Greenland, and cuts her off from direct communication in winter; and secondly, because the attractions of the farther-off western parts of North America have been too alluring, although to reach them it is necessary to pass along by the threshold of this great country. It must also be added that the English have been slow enough to recognize the value of any and every section of North America, and that the vast possibilities and incalculable value of Canada have only now begun to be realized. To this fact the boundary-line between her and the United States is the most insistent witness. Before Alaska, Klondyke, Cobalt, Porcupine, Newfoundland began to be appreciated at their value, years of occupation had to elapse, and even still young Englishmen will not believe that here is a land where a rich return awaits any man who is not afraid to work.

My first deduction from twenty years' acquaintance with Labrador is that it can and will carry, in the days to come, a population as easily as Norway does to-day; it is a better country far than Iceland, with which also I am familiar, and to be greatly preferred to Lapland, Finland, Siberia, and Northern Alaska; and until the wizard hand of man was turned to New Mexico, Arizona, or even to parts of Egypt and West Australia, it was able to offer as good attractions to settlement as any of them. When the distribution of plants and animals that are of service to man is no longer purely fortuitous, when man spends time and energy to find and cultivate vegetables and animals suitable to environments, Labrador will prove to be a country not merely of value to the Empire of which it may be a part, but also to the human race, as an enormous adjunct to the already sufficiently diminished food-producing area of the globe. While millions have been spent and spent intelligently and remuneratively in other parts of the Earth, this great peninsula of Labrador is peerless in her loneliness, and in her failure hitherto to claim the attention of mankind. It is as a prophet of optimism for the future of Labrador, that I would wish my memory to be handed down to posterity. For if ever a race shall rise to people her glorious fjords and inlets, and to wrest her undoubted wealth from her forests and mines, like all northern countries she will evolve a people endowed with those sterling physical qualities that characterized the Vikings of old, and with that resourcefulness and maritime genius which have ever been, and still are, among the most highly prized heritages of the English people. It was, therefore, all the

more astonishing to us that the aborigines of the coast, when lacking words of their own to express ideas, should invariably have supplied them with German synonyms.

Prof. Fernald, of Harvard University, has lately shown most clearly that Labrador is the "Vineland" of the Norse sagas, that the wheat or "veiti" mentioned is obviously our strand grass, the vinber our red cranberries, and the Mosur wood our birch. I would refer those anxious to pursue the subject in detail to the excellent monographs of Mr. Fernald. The President of Harvard has described them as among the best pieces of work produced by the University for many years. If this is finally accepted, the Sagas become a valuable record of geographical discovery. It has always been evident that ethnological and other references are best explained by Labrador being accepted as "Vineland."

The geographical discoveries of the Cabots, and subsequent explorers,



SEA-COAST VIEW OF THE BISHOP'S MITRE (LEFT) AND BRAVE MOUNTAIN (RIGHT).

so far as they relate to Labrador, are most recently and probably most correctly dealt with by Mr. W. Gosling, of Newfoundland, in an exhaustive treatise he published last year, under the title of 'The History of Labrador.' This paper is too short to do more than draw attention to this addition to our knowledge on that subject.

Labrador seems undoubtedly to have acquired the title by which it is now known, from the "labourer," possibly a slave, in a vessel from the Azores, who was the first to sight the land. The inscription on a fifteenth-century map advises us, at any rate, that this is so. There seems no reason to believe that Labrador means "Golden Lips," any more than it means "The Arms of Gold." Labourer's Land is, anyhow, a title far more appropriate to it. The rapidity with which the variation changes as one cruises along the coast, and the difficulties that existed in estimating it, possibly accounted for so many of the ancient maps making the northern end of Labrador lean so far over to the eastward; a variation of compass of over four points, such as now exists at Cape Chidly, would make a map in which it was not allowed for, convey an idea very far from correct. At all the new observation spots fixed by astronomical observations for the chart we are issuing, the variation was duly recorded.

Though the work that originally called us to Labrador was not calculated to include map-making, it involved so much navigating on its inshore waters, that we soon felt impelled to try and get something done in that direction. We found that islands on the only available charts were inserted apparently for purely picturesque purposes; so far as practical utility was concerned in many regions, a sheet like that issued to the "hunters of the snark" would have been equally effective. Only in a few sections can one still, with any safety whatever, navigate by chart or coast directions. And yet this fact was not responsible for the evil odour so long attaching to Labrador in the nostrils of the underwriters; since I have been able, in the capacity of agent for Lloyds, to show that it was not profitable to cast away vessels for the insurance they carried, there has proved to be no reason for the evil reputation which the coast formerly carried.

The water along most of its thousands of miles of coast-line is what sailors call "deep to," and in the words of one of our naval officers "most vessels are prevented from running their keels ashore by striking the cliffs first with their bowsprits." A veritable archipelago of islands exists along the Labrador coast between Cape Whittle and Blanc Sablon, that is, over 100 miles; between Boulters Rock and Holton, over 100 miles; between Cape Harrison and Port Manvers, about 150 miles; between the Kiglapeits and Saeglek bays, about 50 miles, and between Eclipse harbour and Chidly, a distance of 50 more. Thus, far from what is usually supposed, the most inveterate victims of *mal de mer* can enjoy cruising on the Labrador coast; so that with the extraordinary beauty of its northern cliffs and romantic fjords, when a good survey has been accomplished and published, we fully expect to see the already increasing number of visitors able to compete with that of those who now seek annually health and recreation on the coasts of northern Europe. For in addition to other attractions it offers a continuous vaudeville of icebergs unrivalled in the world for size and height, whose fantastic architecture forms itself a unique attraction. These, moreover, do not materially add to the dangers of a visit; for they discover themselves to the navigators of the slow-going coasting vessels in time to avoid danger.

In attempting to understand the meteorology of Labrador two facts must be taken into consideration:—First, the great extent of latitude the country reaches over; and secondly, the presence of the polar current. This is practically the great determining feature of the country. In a series of observations made in conjunction with the late Prof. Adolph Neilson, we found that the sea surface seldom rose in summer above 43° Fahr., except in the bays and inlets, though at the wider ends of some of these, especially in Hamilton and Sandwich bays, the water rose to 60°. Five fathoms down the temperature invariably began to fall, and in water 100 fathoms deep was often below the freezing-point of fresh water. The careful observations of many generations of Moravian missionaries taken for the

TYPICAL TERRACE FORMATION ON THE GRAND RIVER.

BOWDOIN CAÑON BELOW THE GRAND FALLS.

THE GRAND FALLS.

NAIN.

VIEW FROM A HILL NEAR HOPEDALE MISSION HOUSE.

German meteorologists show that on the outer coast the temperature in winter seldom if ever falls below 40° below zero; whereas on the high plateaus about the grand falls, temperatures similar to those of Winnipeg and north-west Canada are sometimes realized. Similar differences maintain in summer, so that with every mile from the coast the opportunity for vegetable growth increases. Also, the liability to frosts in summer, which is a feature of life on the outside, becomes a negligible factor of danger. Unfortunately, however, our summer being short at best is not able to compete in totality of sunshine with even northern Alaska. For our southern latitude affords us only a diurnal rotation similar to that of Great Britain, whereas in the brief Alaskan summer plants grow like Jonah's gourd owing to their enjoying perpetual sunlight.

At the mill at the mouth of the Hamilton river we have seen growing fields of oats and barley that have made us, coming in from weeks on the outer coast, almost believe we were at home in England, where with roads marked by the tracks of horses and carts, with hedges around fields, and frogs croaking in the ditches, it is almost impossible for one only acquainted with the conditions of the outside coast to believe one's senses.

Potatoes cannot be grown remuneratively on the outside coast. Only because it is impossible otherwise to get them has it been thought worth while to expend even the cheap labour of Eskimo women in raising them. They have then to be planted in raised beds with a fencing of lattice-work overhead which can be covered at a moment's notice with layers of sacking to ward off the occasional frosts of July and August. We have secured this year from the Agricultural Department at Washington some polar alfalfa, which, as it grows well in both northern Siberia and Tibet, should succeed in Labrador, if only it can once find sufficient holding ground for its roots.

Space is too limited here to refer at length to the geographical distribution of our trees, shrubs, and plants, and to all the possible adaptations of those calculated to be serviceable. On this subject far the highest authority is Mr. A. P. Low, whose articles on his explorations in the interior of Labrador were published in the records of the Geological Survey of Canada. Pine trees do not grow at all in Labrador proper; spruces, especially *Picea nigra*, and birches, grow as far north as Hebron and thence in a diagonal direction to Ungava bay. The larches, *Larix Americana*, locally called junipers, are our second most abundant tree. Of late they have been dying in large numbers from some fungoid disease we do not understand. The balsams and our poplars are not numerous enough to be of commercial value. The structures of these and all other plants, owing to the coldness of the soil, the dryness of the winds, and the humic acid of the soil, have assumed a xerophilous form which protects them against dryness. This, not the extreme cold, is the real cause of their stunted nature.

As the immediate future of Labrador will depend largely on the

suitability of its timber for pulp wood, I may be excused for devoting a little space to this subject here. Further, this defensive action which stunts our trees, improves rather than injures them for conversion into paper, for it makes the wood more stringy. Naturally it limits the rapidity with which trees can attain the size that makes them worth working, but this also varies very considerably with the distance from the seaboard. Thus on Battle island, at the extreme southern end of Labrador, a larch 9 inches high and $\frac{3}{8}$ inch in diameter showed thirty-two years' growth, and a fir 2 inches in diameter and 13 inches high showed fifty-four years' growth. At Hebron, at the extreme northern limit of the coastal trees, a spruce planted and nurtured in the mission garden attained, after thirteen years' swaddling, the grand total height of 26 inches. Fortunately, in the interior the banks of rivers are mostly steep, and the country between the height of land and the sea a series of hills and valleys as opposed to the great plateau of the interior. The main growths available are thus on hillsides, where humic acid is unable to develop, and where the shelter from cold and drying winds permits reforestation to be much more rapid. Fortunately, also, the period available for growth is increased with the distance from the coast-line. Thus the smallest saw-logs at the mill on the Hamilton river, 150 miles from the coast, average 15 inches across, and counted only sixty rings, while Sir William Macgregor, in our second trip to the coast, noted logs two hundred to two hundred and forty years of age, and still perfectly sound, which scaled 3 feet and over in diameter, and some 7 feet at the butt in circumference. It is safe to say that while there are areas in Labrador, which under present circumstances I do not believe can be successfully worked for pulp, there are others that most certainly can. The policy of the Newfoundland Government in refusing to export the raw material appeals to me as a very wise one, for with pulp wood standing at $12 a cord, and almost unattainable even then in Wisconsin, I have every confidence that there are areas in Labrador that carry enough available timber to be worked successfully. The expense of milling is beyond my province, but Labrador possesses an almost inexhaustible water power, which in the future will undoubtedly be one of her chief economic assets. Let me, before leaving this subject, sound a warning to those thinking of investing in pulp speculations in Labrador. According to Low, while as far north as lat. 54° the forests may be said to be practically continuous except on the highest hilltops, by lat. 55° half the country is treeless, while those that do exist have greatly decreased in size.

The best that one can say at present of the vegetation of our enormous wild garden, is that its coast vegetation is that of the tundra, but has been very little studied. The popular idea is that Labrador does not furnish naturally any vegetables valuable for supporting human life. This is entirely erroneous. I do not believe that anywhere in the world the wild berry crops of Labrador can be excelled. Laying down a sheet, one can in

many places fill it by brushing the carpet of ripe berries on to it directly from the plants with an ordinary bristle broom.

Mr. Seton Thompson has published a list of plants growing in the wilds on which life can be sustained in times of need. Among others, the following are common in Labrador. The value of an acquaintance with their capacities is well illustrated by the fact that Sir John Franklin and his party were able to exist nearly three months off rock tripe alone.

1. *Empetrum nigrum*, blackberry. Almost universal. Abundant.
2. *Vaccinium vitis idea*, red cranberry. Almost universal. Abundant. Wineberry of the Sagas.
3. *Vaccinium Pennsylvanicum*, blueberry. Less common.
4. *Vaccinium* (*Uliginosum*).
5. *Arctostaphylos alpina*, bearberry. Less common.
6. *Rubus chamœmorus*, cloudberry. Less common.
7. *Rubus arcticus*, Arctic raspberry. Less common.

Also the white teaberry and red marshberry.

The cranberry is beginning to be exported in large quantities both for food and for its red juice for dyeing purposes. The blueberry, cloudberry, or bake-apple, and the teaberry are also gathered and preserved, making excellent jams. One of the peculiarities of the cranberry and bearberry and marshberry is that they remain under the snow all winter and sweeten without shrivelling up. Thus often they serve as a preventative of scurvy, from which many formerly died, as well as providing a valuable food and relish when little else is available. Moreover, it is possible for the very poorest to preserve these berries, the only requirement being that you absolutely fill the barrel with water before you head it up. We have also been able to induce settlers now to make use of the abundant *Russulæ* and *Boleti*, which grow on the rocks as far north as Cape Chidly. By stringing these on cotton they dry in the air, and can be easily preserved all winter. Parboiled or fried or stewed, they form a delicious and highly nutritious nitrogenous food supply. How the suspicion that they were all poisonous could have become so rooted all along the coast is difficult to understand. But by frequent experiments *in corpore vili* we have demonstrated both to our friends and ourselves the injustice and the loss caused by this misapprehension.

Iceland moss (*Cetraria*), Reindeer moss (*Cladonia*), Rock tripe (*Umbilicaria*), which most generously support the caribou, and now our growing herd of reindeer, have all been shown to have a nutritive value for man also in time of need. The buds and underbark of the aspen on which our grouse live, the inner barks of the willow and birch, might be put in the same category, also the boiled tips of the spruce. This latter I have frequently used with great advantage on patients suffering with scurvy. *Elymus arenarius*, our strand grass, also affords a starch supply if required. There exist good monographs by the late Rev. A. Waghorne on

the mosses and fungi of southern Labrador. But there remains a vast field of work still to be done at the flora.

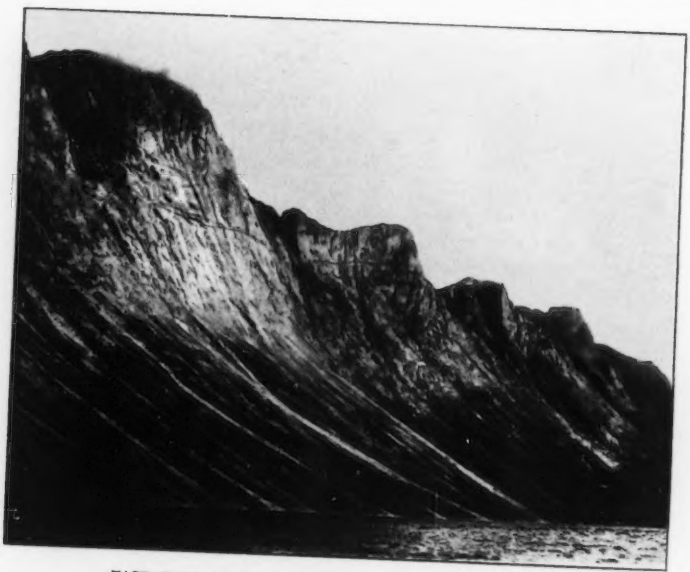
It is almost pathetic to record that with the exception of the summer work done in 1900 by Prof. R. A. Daly, research professor of geology in the Massachusetts Institute of Technology, and by A. P. Low, no serious geological work has ever been done in Labrador. This is to be the more lamented, for the deductions of the few prospectors and others qualified to speak, who have visited the country, show that there is every possibility of mineral deposits of value hidden in its archæan rocks. A large seam of sulphide of iron seen by fishermen cropping out from the cliffs in Rowsell's harbour about lat. 58° 30′, was worked in a half-hearted manner for six months, and then abandoned in 1905. The alleged causes were the narrowing of the seam as the shafts went in, and the short season of open water. In 1907 and 1908 prospectors worked in the large sand delta between Sandwich and Eskimo bays at alluvial gold, specimens of which we were shown. We were informed it was certainly worth working. The same summer a young prospector was searching for a deposit of antimony along Eagle river, specimens of which found by natives were said to promise excellent returns. For one summer mica deposits along Paradise river were worked by a young Scotch prospector, and at Boulters Rock by a Newfoundland firm. Copper was discovered by chance visitors to Mugford island in 1904, but though the specimens were said to be rich in good ore, nothing further has been done with it. Abundant garnet deposits in St. Michael's bay have been taken up by prospectors, but not worked, I understand, owing to an artificial substitute having been found to replace them. Deposits of iron pyrites occur in many places along the seaboard. In 1894 an island near Nain, consisting almost entirely of the beautiful prismatic feldspar known as Labradorite, was worked by an American. This mineral, known to Pliny under the name of Lapis mithrax, we now polish for its exquisite iridescent lustre. Gold said to be discovered at Hebron was the basis of an expedition about the year 1900, but for some unknown reason the vessel never reached so far north. But each and all of these, and other similar indications of the mineral value of Labrador, are practically in sight from the sea. No serious search for the treasures of the endless miles of Labrador has ever been undertaken.

Much of Mr. Low's work having been done in winter, he was deprived of the one unique feature that should facilitate the prospector's task in Labrador. I refer to the "almost indiscreet nakedness" of mother Earth. The attempt by Prof. Daly to tell the story of the internal and external formation of modern Labrador reads almost like a fairy story to even the lay mind. It has been said as an excuse for the lack of interest in prospecting in Labrador that it is due to discouragement from the "pockety" formation suggested by the outer coast deposits hitherto discovered. On the other hand, it should not be forgotten that Secretary of State Seward was blamed for purchasing a valueless Alaska,

GLACIAL BOULDERS ON A RIDGE NEAR ICE TICKALL HARBOUR.

RAISED BEACH OVERLOOKING EMILY HARBOUR, SLOOP ISLAND.

MOUNT RAZOR-BACK.



EAST WALL OF THE SOUTHERN ARM OF NACHWAK BAY.

and that in the continuation of the very same stretch of country England had, a few years ago, no use for the Klondyke or Yukon ; while a railway had been driven through Cobalt long before its fabulous silver wealth was even dreamt of.

While the clearing off by time and ice of the superincumbent rock from the Archæan rocks, which have not been thus denuded in the more distant parts of North America, must naturally interfere with the agricultural outlook of Labrador, I am assured it need not injure the prospects of our mineral development. On the other hand, coal deposits—a continuation probably of the coal-seams of Cape Breton—have been reported, partially prospected, and claims taken up in the region of Forteau, on the north side of the Straits of Belle Isle. I have seen a few small specimens of this coal brought out by fishermen, resembling gaseous cannel coal.

It has always been supposed hitherto that no remains of the ancient ice-cap have persisted in Labrador in the form of living glaciers. But in 1907, Dr. John Bryant, with a party of explorers, while cruising in our schooner the *Lorna Doone*, discovered and mapped one out near Cape Chidly in the northern end of the Torngak mountains. An expedition to explore these mountains would amply repay itself.

Briefly, the striking features of Labrador physiography are the three great mountain ranges that have risen as the result of pressure in a north-easterly and south-westerly direction on the north coast.

1. The Torngaks, or devils, lying between Saeglek bay and Cape Chidly.
2. The Kaumagets, or shining-topped mountains, between Saeglek and Okkak.
3. The Kiglapeits, or dog-tooth mountains, between Okkak and Nain.

The most northern of these afford the highest and wildest scenery along the whole coast of eastern North America.

The evidence of the beaches and glacial remains seem to show that Labrador is still rising absolutely, the northern extremity more rapidly than the southern. It has been estimated, with what exactitude I cannot say, that it is at a rate of 8 or 10 inches in fifty years. The rise of land in post-Glacial times is estimated by the level at which ice-born erratics are deposited. Also their lower limit marks the level at which they were subsequently washed away again by the ancient ocean.

These Torngak mountains include many peaks of the Matterhorn type, and their summits were never submerged beneath the ice-cap of the Glacial period, as those further south certainly must have been. Estimates of the height of the highest peaks have varied from 5000 to 10,000 feet. Our own observations in 1908 did not appear to support these calculations, and though the fact that they rise direct from the sea-level instead of from an elevated plateau magnifies materially the suggestion of altitude, we were unable by calculations from their feet to make any reach the 5000 feet level. The difficulty in getting satisfactory base-lines in the time at our disposal, owing to the absence of foreshore, and the unsatisfactory estimation of base-lines that

can be obtained entirely by gunshot sounds may possibly account for the differences between ourselves and other observers, especially with the experiments made by the members of the *Brave* expedition, who found heights of over 5000 feet in the section of the Torngaks at the head of Nakvak bay, which was calculated by actual ascent and barometer readings. I have myself ascended the highest peaks of the Kaumajet range and by barometer readings corrected by a second instrument left at the base, I was convinced that they nowhere rise, imposing as they are, to more than 3500 feet. That altitude is attained, however, almost directly from the sea. The Kiglapeits have been frequently crossed in winter by my medical colleagues, and we do not believe they exceed 3000 feet.

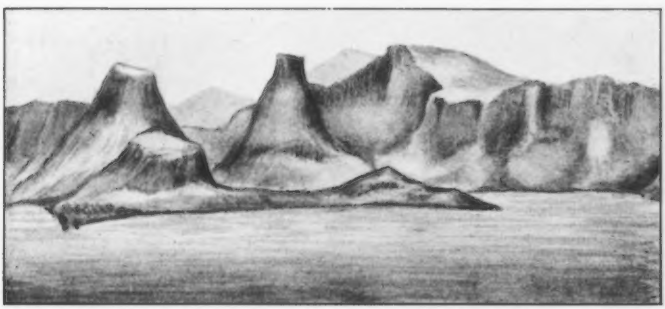
Another very remarkable and attractive feature of all this northern architecture is the marvellous tracery of the huge cliffs, caused by the intersection of the pink and grey gneises and granites by intrusive dykes of almost jet-black trap rock. On a coast where artificial landmarks are conspicuous by their absence, many a navigator has rejoiced to see looming up out of the mist some of the headlands indelibly labelled by this weird arrangement of Nature. One strip of land in about lat. 55° 50′, is absolutely unmistakable, being almost ridiculously imitative on a large scale of cake with layers of jam, so impressive to youth.

Again, the south cape of Rannah is universally known as the muzzle, suggesting, as it does to the dullest mind, a long-nosed dog wearing that familiar appendage in black leather. Twice running in before heavy sea and fog, I have recognized our position by the titanic black pillars that unmistakably identify the entrance gateway to Saeglek bay.

The bays and fjords and tickles or narrow waterways of eastern Labrador will always be one of its chief attractions to the voyager. These so divide the coast that from Belle Isle to Cape Chidly at least one harbour from the ocean can be found in every 10 miles for small vessels. One of these is navigable for at least 140 miles; twelve are navigable for from 30 to 50 miles. There is little or no current in these bays, and it is not till one approaches Cape Chidly that the rise and fall or the rapidity of the current are elements of any account in navigation. There are only a few off-lying reefs that do not show themselves above water, and which are not near enough the surface to be evident in the Atlantic swell even in calm water, and so warn a vessel navigating the outside waters. The most dangerous are in the neighbourhood of the Hog's back, a series of small bare tops of a submerged mountain range that just rise above the surface off the mouth of Komaktorvik or Louse bay, in about lat. 59° 30′. These are still uncharted, and thus form a serious barrier to navigation, except of small vessels between Nakvak and Cape Chidly. So much so that even the Hudson bay and Moravian steamers that every year cruise past this region are obliged to maintain an offing of not less than 25 miles.

It has been my custom for many years, therefore, to try and sketch

SKETCH OF UNGAVA BAY END OF DR. GRENFELL'S HOUSE.



VIEW FROM SEA OFF SOUTHERN SIDE OF BIG BAY BETWEEN MOUNT BACHE AND CAPE KAKKIVIAK.

plans and obtain rough cross-bearings, and so to construct a map for myself by which I could safely cruise close in; and so, assisted by photographs and sketches, to gradually work out at least one safe route through this northern archipelago. Latterly we have been able to fix a number of points accurately, through the co-operation of his Excellency, Sir William Macgregor. We possess also a number of cross-bearings which are accurate, and from which we shall hope shortly to get a map constructed that in some way shall illustrate the contour of northern Labrador. We have also, with Basnett's deep-sea sounder, been able to secure a number of soundings along the line of our routes. So valueless is the existent chart of the region near Chidly, that in 1895 I was unable to find the entrance to the channel between Chidly and the mainland. Since that time I have, however, as a routine practice, made use of that channel as a short cut into Ungava bay, as it obviates the necessity of any time entering Hudson bay straits. It is rendered far more valuable because the eastern entrance to this strait can be approached by a perfectly calm waterway inside islands for at least 15 miles.

We have sounded carefully on many occasions through the channels. There is a small patch of 5 fathoms in one spot marked on a plan we published of this. On each side of the patch is deep water, and in the rest of it we could discover no bottom in less than 17 fathoms. Good holding ground can be found in at least four places along the passage. This is sometimes an essential, since the current flows according to the tide, and at times reaches a speed of 9 knots per hour, boiling up into a whirlpool as the narrows are reached.

The important question as to whether the Hudson bay route will be available for the wheat transport of North-West Canada depends largely on the lateness that navigation can be carried on. Our own experiences seem to show that frequently it would be impossible to get in or out till late in July, but that not enough floe ice accumulates to prevent a properly equipped vessel of large size from getting through the straits till the end of October. Personally, I am of opinion that seldom even in November would hindrance from that cause be insuperable. The Rev. Greenshields, a missionary who has wintered some years in Baffin's Land, assures me the young ice would not hinder a steamer till late November. As for winter harbours, any outside harbour as far north as Hamilton inlet would be available for suitable boats almost up to Christmas, unless in very exceptional years. The Harmsworth paper mills, whose port is Green bay on the east coast of Newfoundland, have now acquired two steamers with 5000 tons capacity, with the intention of making regular voyages to and from England all winter long. In this with care (and no doubt with some delay) I have every faith they will succeed. If so, a tunnel under the Straits of Belle Isle, to carry a railway direct to that port, would be of immense value in Canada, and would link all the possessions of British North America with new and firmer bonds.

There can be no insuperable difficulty in carrying direct cables to Labrador and so across Northern Canada, if only a landfall is chosen where the cable shall enter a fjord deep enough to prevent its being cut by drifting icebergs outside, as has so often been the case in shallow water between Belle Isle and Cape Charles. Much needs yet to be done in the oceanography of the coast. Doubtless, it would incidentally help to solve some of the all-important questions of the movements and possible preservation of the fishes. But enough has been done to show that such an approach to the land could be obtained, without the necessity of traversing ground involving that danger.

I have no space left to touch on the ethnology here. We are trying to introduce reindeer, of which we calculate Labrador could easily support 3,000,000, and be a meat-supply to the world. Cold storage for transport is badly needed now; it would then be a necessity.

I will close by calling attention to the sad need for protection of all its animals, especially its salmon, trout, and waterfowl. This is shown by the fact that its geese and ducks, seals, cod, and herring are diminishing. Its mackerel and once innumerable curlew have disappeared already.

The PRESIDENT (before the paper): Our lecturer here to-night, Dr. Grenfell, is so well known in connection with his admirable missionary work in Labrador that few words are needed to introduce him to you. He was a graduate of Oxford, and he obtained the membership of the College of Surgeons. Some of his earliest experiences in Europe were in connection with missionary work with the Deep Sea Mission. In 1892 he went out to Labrador, and became Superintendent of the Labrador Medical Mission. In carrying out that excellent work he undertook a number of most useful services. He helped to create more than one hospital; he did admirable work amongst the natives; he built an orphanage, and he started two or three industrial schemes. But probably, from the point of view of geography, the work most to be mentioned is his survey work on the coast of Labrador, the result of which has been that both the American charts and the English charts have been considerably modified in consequence.

Mr. H. HESKETH PRICHARD: I have listened to Dr. Grenfell's paper with a very great deal of interest. It is quite true that the charts of a part of the coast have been, and in some places still are, very doubtful. A point that struck me in Dr. Grenfell's paper was his remarks on the future of Labrador. After being there, one cannot help thinking that there may be in the near future a good and probably very prosperous time coming to Labrador. The only thing I hope is that the prosperity will not come in too great a hurry—that it will not be over done. In Southern Labrador the pulp industry has a future, but it behoves investors to be very careful in what companies they invest, as in Labrador there may be a lot of timber in a river-valley, and only half a mile up on the barrens no timber at all. One thing I certainly think may have a great influence on the future of Labrador, and that is her salmon. It is true that the mosquitoes are trying at times, but perhaps something will be found which will, at any rate, alleviate the tyranny of these awful pests. There is, however, no reason why, if the rivers are properly looked after, and netting prevented as is now being done, Labrador should not become the great playground of the West. With regard to the larger animals, such as caribou, etc., they are, I think, more in

need of protection against forest fires and against wolves than against man. Forest fires have swept over Labrador and devastated the face of the country. I do not think I have anything else to say except to wish Dr. Grenfell, the Moravian Missions, and the London and Continental Mission the greatest of success in the very noble work which they are doing each in their own sphere of influence in Labrador.

Mr. G. M. Gathorne Hardy: I am afraid I did not come here prepared to say anything, and I do not know, speaking off-hand, what I have to say. I should like to emphasize something with regard to trees. The thing that struck me very much was the extraordinarily slow growth. If you cut away the trees, it is a very long time before you can hope to have them growing up again. I believe that when the Moravian Missions were first settled at Nain, more than a hundred years ago, they found timber on the spot with which they could build their houses. If you go now you will find it has all been cleared away. They have been protecting what is left for a very long time, and none of it is any size there. I remember at the other end of our journey, where for days we had seen no trees or any signs of trees, we saw a lot of big old roots of quite large trees. All signs of the fire which must have destroyed them had disappeared, and yet there was not a sign of any new growth coming up again, and the whole place was absolutely stony barren, so I should think, before any one went in there extensively for the pulp industry, though one cannot speak for the whole of so large a country, it would be necessary to consider very seriously the possibility of new growth.

With regard to reindeer, I think that they still exist in enormous quantities, but they migrate in such large herds that you may very easily miss them. At the time that the horns are clean it would be extremely difficult to live on the barrens where they are most to be found, because there is practically no fuel. It is extremely difficult, by gathering together a little birch which grows no thicker than your finger, to collect enough of that kind of fuel to cook a very simple meal, and you could not make a fire for warmth at all. Of course, they may come down to the coast, but it is very difficult to be sure of meeting them over such a long extent of coast as you get in Labrador.

The President: We have heard how Dr. Grenfell studied the art of navigating his own vessel, purely with the object of carrying on the work he had in hand—that of a medical missionary. But what was the result? By studying navigation he learned to survey, and with this knowledge he was enabled to make some excellent maps of this little-known and desolate coast. In this I cannot help thinking he has set an example which might be followed by missionaries in many parts of the world. If they would take the trouble to learn something about surveying, they would often be able to bring back from distant parts interesting topographical details which could be worked up into our maps at home. No doubt these opportunities are becoming rarer and rarer, but there is still an immense part of the world which is not yet well known, and where valuable information could be obtained Dr. Grenfell went out mainly with a view of acting as a medical missionary, and splendid work he has done. But although his geographical studies have been the work of his leisure hours, so to speak, he has been able to give us an excellent broad and general account of this country, which enables us to realize clearly the nature of these wild districts.

THE MACLEOD FALLS* ON THE MAO KABI, FRENCH EQUATORIAL AFRICA.

By P. A. TALBOT, B.A., F.R.A.S., F.L.S., F.Z.S., etc.

On our arrival at Lere, in French Ubangi, we learned that no European had as yet succeeded in discovering the falls of the Mao Kabi, which are mentioned in Commandant Lenfant's book, 'Le grande route du Tchad.' Monsieur Bertaut, the Resident of the district, was determined to find them before his return to France, and on learning our wish most kindly agreed to our joining in the search.

On October 25, therefore, Miss Olive MacLeod, my wife, and myself set out for Fuli, where we were joined next day by our kind escort, who was unable to start before owing to stress of work.

We had heard much of the difficulties and dangers of the march, of the depth of the many rivers to be passed, and the strength of their currents; but save for that of the Mao Kabi itself, however, which was strong enough to strain to the utmost the strength of the paddlers sent up from Lere, we found the way easy. Many a steep-banked bed was crossed, but at that season boulders were found to act as stepping-stones over most of the deepest parts, and in many places only a few pools were to be seen lying cool and seductive here and there along the sandy bottom. Our camp was reached without the least hardship, and while dining a breeze sprang up, on which was borne the sound of the far-off falls.

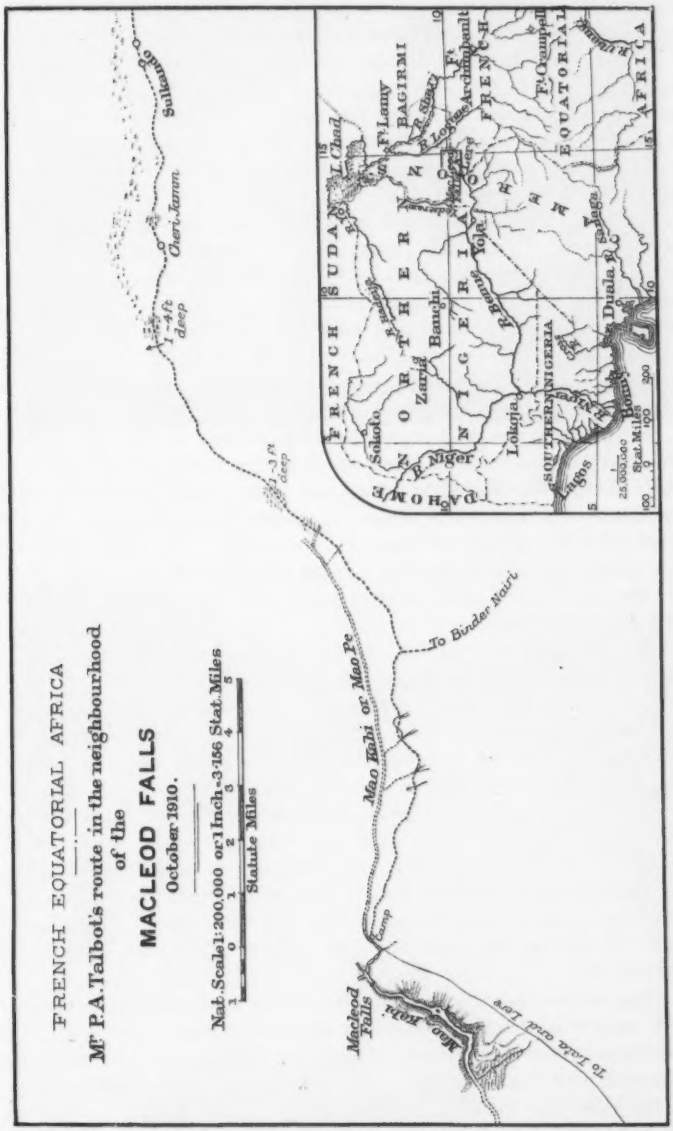
According to local legend, these had never yet been seen by mortal eyes. Natives shun them because of the devils who are said to dwell within; while Europeans are kept from profaning the solitude by troops of guardian giraffes, which have only to show themselves in order to lure away white intruders.

Next morning at sunrise we set out, through a hunter's paradise. At each little stream where water was still to be found, great lion pads were printed in the soft wet sand, and on the road itself tracks of rhino, hippo, bush-cow, and hartebeest were plentiful. Before long the Mao Kabi was reached, at a point where it is joined by a small tributary, and on the other side of this we pitched camp.

The natives assured us that the falls lay to the eastward, so we followed their directions. It soon became evident, however, that no considerable rise of land was to be hoped for on that side. We therefore decided that our guides were probably in league with the guardian giraffes in trying to lure us away, so recrossed the tributary, and followed the course of the Mao Kabi. The way led through high grass, and bush unusually thick for this part of the world, and was strewn with

* The permanent retention of the name MacLeod Falls depends on its adoption by the French Government.

great masses of rock, the clefts and fissures of which were hidden by the



undergrowth. The banks rose generally on either side into sheer walls

of granite, between which the river swirled down in a series of rapids, at the rate of about 10 miles an hour, while every step brought us nearer to the deep boom of the falling water.

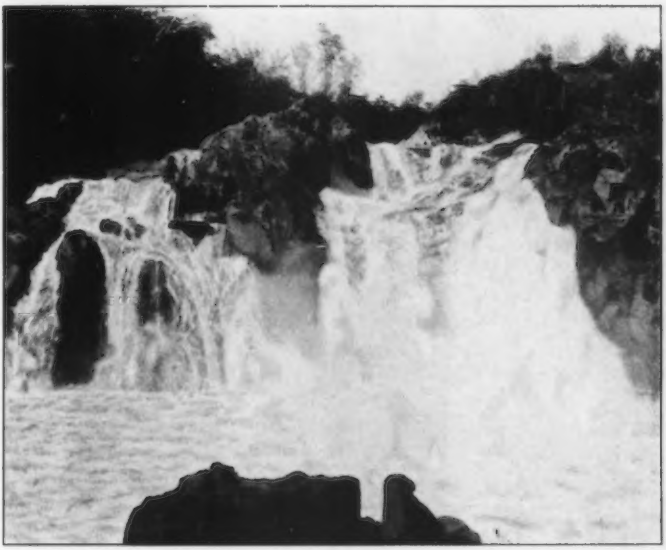
After some distance, the opposite bank was broken by a beautiful cascade, a little further another appeared with a greater volume of water, and after a scramble of about ten minutes more, a spot was reached where two rivers came foaming down in a long series of falls. Owing to want of time, it was impossible to find out whether these rivers were distinct tributaries, falling into the Mao Kabi, or simply branches of the latter, which had split off by the Tuburi lakes, and here rejoined the main stream. They seemed, however, to be distinct; the more southerly one is probably the Mao Lide. The cascades are separated from one another and from the main stream by steep promontories of jagged rock, wooded up to the summit, and form with the Mao Kabi itself, which bends sharply at this point, a great gleaming St. Andrew's cross. After photographs had been taken it was too late for further exploration that evening, so, very reluctantly, we returned to camp.

Next day, to our great regret, Monsieur Bertaut was obliged to leave, owing to pressure of official work, so all further investigations had to be made alone. We decided to retrace our steps toward Fouli, and follow the course of a river which seemed to promise to lead us into the Mao Kabi, after the latter had reached a lower level. The sandy bottom of this stream was thickly marked in many places by lion tracks and those of other bush beasts, while its steep banks were overgrown by patches of blue and pink flowers.

At this time of year the upper stretches were almost dry, but it did not form the easy road for which we had hoped, as it was barred every here and there by precipices of sheer granite, worn smooth and polished in places by the water which dashes over them during the short rainy season. Several of these walls were 20 to 40 feet high, and at their bases clear pools were usually to be found.

When the lowest level was reached the water became continuous, and finally broadened out into a great swamp, across which the Mao Kabi could be seen in the distance, just breaking out from its deep gorge. We decided not to skirt the swamp, but to strike the river again at a point further up on the left bank. This was done, though it was somewhat difficult, as the river was now enclosed by granite walls about 400 feet high.

The sun beat down with such intense heat as to make the masses of rock over which we had to scramble almost scorching to the touch. An unfortunate leak was discovered in our water-bottle, and we found ourselves, with lips so parched as to crack with the heat, gazing longingly at the clear, cool unattainable water below. After a while a spot was reached whence one of our men managed to climb down at great risk and get some for us. A little later we came suddenly to the place where the



THE MACLEOD FALLS ON THE MAO KABI.

THE RAPIDS.

THE MAO KABI, SHOWING THE HIGH BANKS OF GRANITE.

whole river slides over a precipice at least 60 feet high. The detonation was terrific, owing to reverberation from the walls on either side.

After a scramble down almost perpendicular rock, a point was reached which jutted over the water in such a way as to make it possible to take

photographs. Clouds of spray were driven in every direction, so, though we tried to protect the lenses, good results are somewhat doubtful.

No words can do justice to the beauty or grandeur of the scene. At this time of year the river is still full, and the mass of water flings itself over in a resistless green torrent, to break into masses of gleaming foam and seething rapids. At the base of the fall plays a rainbow of elliptical shape, about 200 feet in diameter. This is caused by the sun shining through the clouds of spray, on which the quivering, dazzling tints perpetually play, and thus form a great contrast of peace to the turmoil of the water.

The mysterious falls have given up their secrets at last, and without the firing of a single shot to affright their strangely shaped gentle guardians.

A long-enough stay was made in the neighbourhood to enable me to map the river from above the first fall to below the last. This was rendered rather difficult through the steepness of the ravines by which the banks were broken, and which necessitated perpetual descents and reascents.

Perhaps it may be remarked that these falls are of considerable importance, as they form the main obstacle to a navigable waterway between the ocean and Lake Chad.

As the falls had no native name, Monsieur Bertaut made the kind suggestion that they should be called after Miss Olive MacLeod, daughter of Sir Reginald MacLeod of MacLeod, who had gone every step of the way during their exploration. Colonel Maillard, Commandant du Territoire Militaire du Tchad, expressed his cordial approbation.

It would be ungrateful to end this little account without a word of thanks to the French authorities, who not only showed us the greatest kindness during our whole stay in their territory, but so generously welcomed our presence on this little journey of exploration.

INAUGURATION OF THE OCEANOGRAPHICAL INSTITUTE OF PARIS.

WILLIAM S. BRUCE, LL.D., F.R.S.E.

Before Stanley crossed Africa, Nansen the North Polar basin, and before Peary reached the North Pole, Shackleton the highest southern latitude, and David the south magnetic pole, many thought these feats were to be the end of geographical exploration. Now it must be generally recognized that they were but the opening of the door to newer, wider, and more intensely interesting fields of exploration.

Recently Sir John Murray and Dr. Hjort have, by their exploration of the North Atlantic, shown how much is yet to be done in the exploration of the sea; and last month the Prince of Monaco crowned his

endeavour to establish oceanography as a definite branch of geography by co-ordinating, as it were, his researches in the deep sea and high atmosphere from the tropics to the Polar Regions by the establishment of the Oceanographical Institute of Paris.

The Oceanographical Institute of Paris is but a small part of a greater organization. For there are at Monaco three ships, the *Steno*, the *Eider*, and the *Princesse Alice* (which is about to be replaced by a slightly largely and more efficiently equipped vessel), and the great Oceanographical Museum of Monaco which houses and guards the treasures brought from the deep by these and other vessels in which the Prince of Monaco has conducted his researches during the last twenty-five years. The Prince has, in fact, aptly called the Institute in Paris the "retail house" of the great "wholesale establishment"—factory and warehouse—at Monaco.

Whereas the ships and museum carry on actively oceanographical research, the Institute is to foster public interest in oceanography and to give university students an opportunity of gaining an insight into its aims and objects. Thus the Oceanographical Institute of Monaco and Paris is composed of two parts: (1) The "Musée Océanographique de Monaco"; (2) the "Institut Océanographique de Paris." The two establishments form one Institute with an unbroken interchange of work, experimental at Monaco and didactic at Paris, all the work being co-ordinated with one aim—the advancement of oceanography.

The Institute is French and international—French because it is situated in Paris, and because the business affairs are being conducted by a purely French committee, the "Conseil d'Administration"; international because the scientific and technical administration is vested in a body called the "Comité de Perfectionnement," the members of which committee are chosen from the whole world, without distinction of nationality, and is composed of those who are qualified oceanographers. The Prince of Monaco is President of this committee, Mr. J. Y. Buchanan, F.R.S., Vice-President, and the other British representatives are Sir John Murray, K.C.B., F.R.S., and the writer. Other members of the committee are Dr. Jules Richard, who has so long been the able chief of the Prince's scientific staff, and who is now Director of the Museum of Monaco, which owes so much to his great success as an administrator and to his devotion, not only to oceanography, but also to his chief; Dr. Paul Regnard, Administrator of the Institute in Paris; Prof. Carl Chun, of Leipzig; Prof. Hergesell, of Strasburg; M. Forel, of Lausanne; Dr. F. Nansen, of Christiania; Commandant F. A. Chaves, Director of the Meteorological Service in the Açores, and several others. The late Prof. Agassiz represented the United States on the committee. This committee, it will be seen is not only international, but thoroughly representative of oceanography. The Prince has combined art with science in the erection of the Institute by having chosen M. Nénot as architect. Situated in the heart of the Latin quarter in the Rue St.

Jacques, it is destined to take an important part in the educational life of Paris. It is built on the part of the site of the old property of the "Dames de Saint Michel" which was acquired in 1906 by the University of Paris, with the help of the State, of the city of Paris, and of the Prince of Monaco, the University having ceded that part occupied by the Institute to the Prince of Monaco.

The central feature of the Institute is contained in a large lecture theatre accommodating eight hundred people, and in which it is intended to give courses of popular lectures on Oceanography. This large lecture theatre is ingeniously combined with a smaller one, which is suited to accommodate eighty persons, and which is suitable for conducting systematic scientific courses of lectures to University students. The auditorium of one theatre faces that of the other, and a screen forming the lantern screen for each theatre divides the one from the other. The small lecture-room also forms additional seating accommodation should the large one be at any time crowded.

The Administrator of the Institute is Dr. Paul Regnard, who has for many years been associated with the Prince's work. His house forms part of the building, so that the Administrator is always on the spot. Under him are three professors—Prof. Berget, for the study of Physical Oceanography; Prof. Joubin, for Biological Oceanography; and Prof. Portier, for the study of physiology of marine animals and plants. Each professor has a very comfortable private room of his own, and attached to it a well-equipped laboratory with every scientific requirement, and even many scientific luxuries, including a spacious and well-fitted photographic dark room to each of the three departments. These private laboratories are each large enough to accommodate several research students if the Professor of the Department so desires. There are, besides, a few small laboratories, which are set apart for specialists of any nationality to carry out any special research.

There is a good library, which will be subsidiary to the important library that already exists at the Museum at Monaco. Two large rooms are set apart for aquaria—one containing four large tanks, and the other which is to contain a larger number of small aquaria where living animals can be observed. The aseptic dissecting chamber and theatre forms a novel and interesting part of the institution, and close by is a crematorium for the disposal of organic waste products. There is a good mechanic's workshop, fitted up with every possible requirement, and in charge of an excellent mechanic of the French navy. Already as an example of work that can be done in this workshop, it may be mentioned that a small sounding machine, which is used on board one of the Prince's ships, was entirely constructed there. There is also a special room fitted to contain some 96,000 lantern slides.

The "secretariat" is an important part of the Institute, as well as a handsome council chamber, in which the "Conseil d'Administration"

and the "Comité de Perfectionnement" meet. The secretary's room is decorated in a very beautiful and original manner by a young artist, M. Laugier, who has passed several years studying in the Museum at Monaco, at the Sorbonne, and at Roscoff. He has thus become thoroughly familiar with the forms and colours of many living marine animals and plants. He has represented on the walls of the secretariat a scene below the sea, so that the secretary lives in a veritable aquarium—wonderful molluscs, crustacea, and strange fish swimming round among rocks and and waving seaweed, and the whole culminating in a whirlpool in the centre of the ceiling in which is figured a cuttle-fish with its outstretched arms.

The council chamber is richly but gracefully ornate, though more orthodox. The large lecture theatre is of excellent Florentine architecture, with fine panels by M. Louis Tinayre, who has accompanied the Prince on board the *Princesse Alice* during several voyages, not only in the Mediterranean and Tropics, but also in Spitsbergen. One panel represents oceanographical operations on the deck of the *Princesse Alice*, especially the taking on board of a trawl and a trap from the deep sea. Another represents a whale-boat in charge of the Prince, who is fast to a whale. A third represents the selection of the larger material from the trawl on the deck of the ship, while a fourth pictures finer work being carried out below, inside the scientific laboratory.

The inauguration was presided over by the Prince of Monaco himself, and was graced by the presence of the President of the Republic, M. Fallières, and many members of the Government, and by ambassadors and ministers of Foreign Powers at Paris. There were also the members of the Conseil d'Administration and of the Comité de Perfectionnement. A guard of honour formed from the Republican Guard lined the streets outside the building, and the band of the Republican Guard played the "Marseillaise" and the Monagasque national anthem as the President of the Republic and the Prince of Monaco entered.

The proceedings were opened with an eloquent address by the Prince of Monaco, who pointed out that the opening of the Institute was the crowning of the work he had devoted his life to during the last twenty-five years. After giving an account of the aims and objects of the Museum and Institute in a fine peroration, the Prince said he had chosen Paris for the seat of the Institute as a centre of literature, art, and science; but it is best to quote his own words, which greatly touched his audience.

"Si j'ai choisi cette capitale pour y centraliser mon œuvre, c'est que Paris a gagné la reconnaissance du monde intellectual: les lettres lui doivent un rayonnement incomparable, les arts ont chez lui une de leurs plus généreuses patries, la science lui doit l'affranchissement qui ouvre à la pensée des champs sans bornes. Mais c'est aussi parce que certaines âmes demeurant toujours sous l'influence de l'atmosphère où sont nees

leurs premières affections et où leurs vieilles tendresses sont mortes; où des peines ont fortifié leur courage et où les contingences de la vie ont orienté leurs efforts.

"Le musée océanographique de Monaco semble un vaisseau ancré sur la côte avec des richesses extraites de tous les abîmes; je l'ai donné comme une arche d'alliance aux savants de tous les pays.

"L'édifice où nous sommes recueillera la quintessence du travail élaboré par l'oceanographie qui planera idéalisée sur ce vaste domaine universitaire, au milieu du flot grandissant de la science. Et je le confie à cette ville de Paris qui m'a enseigné le travail et dont l'esprit et le cœur ont si souvent dirigé l'esprit et le cœur de l'humanité entière."

The Prince was followed by Monsieur Maurice Faure, Ministre de l'Instruction Publique, speaking in the name of the Government, who eloquently thanked the Prince on behalf of France and the University for his gift. Others who spoke were Monsieur Armand Gautier, President de l'Academie des Sciences, and Monsieur Liard, Vice-recteur à l'Academie de Paris, as well as Monsieur Perrier, Directeur de Museum d'Histoire naturelle.

Finally Mr. Henry Bourée, aide-de-camp of the Prince of Monaco, gave some very excellent photographs and cinematograph views of work on board the *Princesse Alice*. These included some very fine colour photographs of living invertebrates that had been gathered during some of the cruises, the most striking of which was a brilliant physalia, glittering with translucent violet in the sun. The cinematograph showed the movement of the physalia in a glass tank.

THE COLOURING OF RELIEF MAPS.*

THE rapid development of aerial locomotion in recent years has produced a demand for maps specially adopted for use under such conditions, and discussions have taken place between aeronauts and cartographers in order to arrive at the most suitable method of representing the Earth's surface to meet the special requirements. The present brochure is apparently the outcome of the Luftschiffer-Konferenz which met in Berlin in November, 1909, and expressed an opinion that hill-shading with vertical lighting and a colouring of the higher ground which passed successively into darker tints of a single colour as the altitudes increased would probably best meet the case. Dr. Peucker has long studied the representation of relief by a colour scheme, and he here develops this idea in the form that he considers would be most suitable in maps for the use of aeronauts. Incidentally he discusses many points of interest in general cartography, and though much has been written on the continent, but little has appeared on the subject in English.

Maps which show the relief of a region may either indicate the altitude of

* 'Höhenschichtenkarten.' By Dr. Karl Peucker. Stuttgart: 1910. Pp. 59. Maps.

different portions by means of figures or by contour-lines drawn at specified intervals; or by shading, gradations of colour, or the employment of different colours in different zones, they may present more clearly the actual form of the Earth-surface. Colour schemes of this nature date from the early years of the nineteenth century, when von Hauslab in 1828 employed the gradual intensification of colour to indicate increasing altitude, "the higher the darker." Since then many methods have been employed to meet the conditions imposed on the cartographer when dealing with the relief of a region, viz. (1) to show the actual altitude of any point, (2) to indicate clearly what is higher and what is situated lower, and (3) to reproduce as far as possible the effect of the general relief. Colour is the only satisfactory means of treating this third dimension graphically, and the methods employed may be grouped in three categories: (*a*) contrasted colours, (*b*) graded tints of a colour, (*c*) natural colours to indicate certain geographical regions. Typical instances of these different systems are given, and they are examined to see how far they fulfil the three conditions already laid down, and especially their suitability for the aeronaut, who requires to read variations of relief quickly and accurately, to orient himself with facility, and to obtain the information needed for this from a map of which the scale can hardly exceed 1 : 200,000, and may often be less.

In using contrasts of colours the number may be considerable, since Colonel Moedebeck requires (*Pet. Mitt.*, 1909) twenty zones of colour to be shown; the production of this number offers no difficulty, but it is desirable to reduce the number of printings as much as possible, and to arrange the colours so that unusual altitudes can be recognized easily without ambiguity and without constant reference to the colour scale. Graded tints becoming deeper as the land rises involve using dark shades on mountain summits, and thereby obscure the width and position of the passes and high valleys, which in the present connection may be of special importance. The regional colours adopted by Sydow, green for low lands, and brown for high land with white dividing them, may be used to show relief by suitably grading the tints; but the practicable number is not large, and as the range from 0 to 4000 metres is required in aeronautical maps, this method would require supplementing. Dr. Peucker proceeds to urge strongly the advantages of his scheme, which makes use of the optical characteristics of colours. Their brightness and degree of saturation form the basis of gradation, and the angles of refraction increasing from red to violet determine the order of the different colours in the scale. When a red and a violet object on a map are viewed by eyes of normal vision, the focus of the red rays is shifted in both eyes outwards towards the temple, and that of the violet inwards towards the nose, producing an effect similar to that of viewing near and more distant objects.* On this basis the spectral colour scheme is constructed in which, blue being reserved for water and spectral violet not being obtainable as a pigment, a grey is taken for the lowest zone from which the scale passes up through green, yellow, orange, into red, in rising from 0 to above 3000 metres. Where portions of the scale only are required, the effect can be improved by brightening the higher tints employed, and by darkening the lower, or descending more quickly in the scale, thereby gaining in contrast, so that the scheme is adaptable within certain limits. The result as shown in two plates of a portion of the Austrian 1 : 200,000 map of the Alps to the south-east of Botzen is distinctly good. The high peaks and ridges stand up well in bright clear colours which in no way obscure the detail, and passes and valley lines are

* E. and A. Brückner, *Mitt. K.K. Geogr. Ges. Wien*, 1909.

well presented. The use of dark grey for the lowest zone 0–300 metres is less attractive, though it combines well with the remainder of the scheme, but it would not allow any considerable amount of detail to show up on it effectively. Theoretically the scheme has many advantages, and is said to need but four or five printings for the full scale, but the practical merits of this and other proposals which have been put forward (*Pet. Mitt.*, Pl. 35, 1909) can only be adequately determined by experiments in which facility of reading form, legibility of detail, clearness of colours in both natural and artificial light, and many other points can be tried. But wherever colours are employed to reproduce the effect of relief the teachings of physiological optics should be kept in mind; and even where the object is only to differentiate one area from another by contrast of colour, the best effect will be obtained by their aid. Where graded tints of green, yellow, and red-brown have been used to produce a relief effect, the addition of a grey or violet for higher ground spoils the sequence and gives the effect of depressions where the highest ground lies. This may be seen in the Monmouth sheets of the "half-inch" layer map of the Ordnance Survey, and other sheets would show the same but that the half-tone shading is heavy enough to aid the relief effect. On large-scale maps, however, the surfaces are usually so large that the different colour tints hardly fall close enough to produce their full effect, and the result is in most cases rather a scheme of colour-contrast. In atlas plates, however, it is different, and in one recently published the relief effect of such a colour scheme was wholly nullified by the violet-grey used for the higher levels. Shading the hill slopes under conditions of inclined lighting is of great assistance in bringing up the relief effect, and in high ground where there is not much detail to be obscured it is very useful; but its value lies in showing the steeper slopes of major features, though smaller detail may be a good deal obscured by its use. Dr. Peucker uses this, the lighting being from the south. A very similar colour scheme is used on the new edition of the 1 : 250,000 map of Bavaria, with lighting from the north-west, and proves very effective, and in the international 1 : 1,000,000 map, the seventeen colour-shades adopted by the committee are arranged much on the principles advocated by Dr. Peucker, except that while the browns grow darker with increasing height, the succeeding red group grow lighter in the same direction; also a pink colour is used instead of the vermilion of Dr. Peucker's aeronautic map.

H. G. L.

DR. A. BRILL'S METHOD OF DETERMINING THE GEOGRAPHICAL POSITION IN AERIAL OR MARINE NAVIGATION.

By E. A. REEVES.

With the advance of aerial navigation attention has naturally been directed to the question of the most suitable method of determining the geographical position of an airship by astronomical observations of stars at night. On the continent, specially in Germany, quite a number of devices and ingenious arrangements have been brought out for the purpose during the past few years, the latest, and perhaps the most promising, of which is that described by Dr. Alfred Brill, of Frankford-a.-Main, in parts xi. and xii. of *Annalen der Hydrographie* for 1910.

What is, of course, aimed at in all of these methods is simplicity of observation and the minimum amount of computation, to ensure rapidity in arriving at the result. Under the circumstances, no great accuracy can be expected, or possibly obtained. In the first place, the altitude of the star has to be measured from the deck of the balloon with some special form of sextant fitted with a level which can only give approximate results; and then the methods of determining the position afterwards, to do away with computation as far as possible, are in great measure graphic, which necessarily renders refinement out of the question. Still, after all, if the position can be quickly found within a few miles, this is perhaps all that is required.

Most of the rapid methods proposed for determining the geographical position from astronomical observations, in their fundamental principle, depend upon some development of the 'Sumner Lines,' with which marine navigators are well acquainted, and have learned to esteem so highly, and the drawing of which can now be greatly simplified by the use of some of the numerous tables that have been computed to facilitate the operations.

The method described by Dr. Brill, which has been specially devised for aerial navigation, although it is equally suitable to the mariner, is a simple and ingenious development of finding the "position line" on the Saint Hilaire system. Still, whilst it is based upon this, it differs from it in many respects, and must to a great extent be considered original. It is interesting to learn that the method has secured a first prize at the International Aeronautical Exhibition recently held in Frankfurt.

A map of a special region to be traversed by the airship is drawn upon an equidistant zenithal projection, with true azimuths and distances from the central point, and printed on transparent material. This map is circular in form and mounted in a frame, so that it can be rotated and set to any required azimuth. The centre of the map, or the point of intersection between the central meridian and central parallel of latitude, is clearly marked, and for this point tables have been computed giving the altitude and azimuth of certain bright stars corresponding to their hour-angles from this point of the map. Covering the map, but independent of it so that the two can be turned round one on the other separately, is a sheet upon which is drawn a series of short sections of concentric circles of equal altitude, which appear nearly straight and represent "position lines"; and through the middle of these lines runs, at right angles to a tangent at their centre, a single straight line, answering to the "intercept" and bearing line, to be set to the bearing of the star. This covering sheet of sections of equal altitude circles is carried by a separate frame and attached at the ends to two rollers by which it can be rolled up or down so that any special altitude circle, or position line, can be made to pass through the central point of the map, and, owing to the material used being transparent, the map and the "position lines" can both be seen at the same time.

When it is required to determine the geographical position, the proceeding is as follows: An altitude of a suitable star is measured and the chronometer time (Greenwich or of some other meridian) noted, for which time the corresponding hour-angle of the star from the meridian passing through the centre of the map is quickly computed. With this hour-angle and the declination of the star, the table previously referred to is entered, and the corresponding altitude and azimuth of the star noted. Then, turning to the instrument, the altitude or "position line" sheet is moved up or down by turning the rollers until the

line corresponding to the altitude taken from the table cuts through the centre point of the map, and the map is then turned round horizontally until the azimuth given in the table is indicated by the straight line which bisects the equal-altitude lines. The "intercept," or difference of altitude between the altitude shown by the line passing through the centre of the map and that observed, is then noted, and the equal-altitude line corresponding to this is the "position line" somewhere upon which the observer is at the time the altitude was taken. The same operation is performed with another suitable star, or a latitude by *Polaris* is found, and the point of intersection of the two "position lines" fixes definitely, as usual, the observer's place on the map. In the example, of the working of this method given in Dr. Brill's account, a map of Germany and parts of adjacent countries is used, with the intersection of the 50° parallel of latitude with the 10° meridian east of Greenwich as the central point.

Dr. Brill's first article (in Heft xi.) is followed by a description, by Herr O. Voigt, of a special instrument for the plotting of position lines, constructed on this principle, which is intended for use at sea as well as in airships.*

Graphic methods of this description can only give approximate determinations, and the question is whether the accuracy that can be attained will be found to be sufficient for practical purposes, even provided the altitude can be measured with the required exactitude, which would be no easy matter in an airship. Another drawback to the system seems to be the necessity for having separate maps prepared, each with its own special central point, for which tables must be computed, and which, to be on sufficiently large scale, cannot include any very extensive area without becoming inconveniently large. Still, this latest method of determining the "position line" is decidedly ingenious, and, it is to be hoped, will be found of practical value.

THE UGANDA-CONGO ARC.

The following communication has been received from Colonel C. F. Close, C.M.G., R.E., General Staff, for the Director of Military Operations:—

"I am directed to forward herewith a copy of the list of geodetic positions of the stations of the Uganda arc, rigorously computed from the work of the Anglo-Belgian Commission towards which the Royal Geographical Society contributed so liberally.

"It is intended to publish a full account of the operations and calculations connected with this work, and the second part of this publication will contain a discussion on local attraction, based on a comparison between the above positions and the astronomical latitudes now being computed by the Belgian astronomer, Monsieur Dehalu."

* In a third paper, printed in Heft ii. of the *Annalen* for 1911, Dr. Brill discusses the theory of the instrument.

LIST OF GEODETIC POSITIONS COMPUTED FROM THE ANGLO-BELGIAN TRIANGULATION.

Station.	Latitude.	Longitude.
	° ′ ″	° ′ ″
Isura	1 10 43·745 N.	30 11 13·8 E.
Lake Albert Station	1 2 41·376 ,,	30 31 37·7 ,,
Makoga (Base N)	1 0 48·787 ,,	30 19 12·6 ,,
Omunturok	0 59 28·017 ,,	30 3 4·6 ,,
Muruha	0 56 44·644 ,,	30 35 56·5 ,,
Lyanda	0 56 12·141 ,,	30 34 34·7 ,,
Kibuku (Base S)	0 54 50·693 ,,	30 12 33·4 ,,
Oruha	0 39 4·415 ,,	30 30 30·5 ,,
Karangora	0 38 7·779 ,,	30 7 17·2 ,,
Nkenda	0 14 51·449 ,,	30 5 57·3 ,,
Kabuga	0 13 27·359 ,,	30 28 53·3 ,,
Singirro	0 15 36·925 S.	30 30 3·6 ,,
Kasunju	0 19 21·504 ,,	30 4 57·0 ,,
Mbarara (Old Fort)	0 36 46·942 ,,	30 39 10·4 ,,
Karamrani	0 43 9·992 ,,	30 32 22·0 ,,
Kiara	0 43 14·574 ,,	30 12 23·0 ,,
Igurua	0 57 19·625 ,,	30 21 51·8 ,,
Nyaruwari	1 3 36·554 ,,	30 2 39·2 ,,
Kichereri	1 10 41·650 ,,	Initial point.

Clarke's 1880 figure of the Earth was used in computing these positions, the elements being—

A = 2092 6202 feet.
C = 2085 4895 ,,

NOTE.—The value of the metre has been taken as 39·370113 inches.

REVIEWS.

EUROPE.

SCHLESWIG-HOLSTEIN.

'Topographie des Herzogtums Schleswig.' Von Henning Oldekop. 'Topographie des Herzogtums Holstein.' By the same. 2 vols. Kiel: Lipsius & Tischer. 1906–1908. *Price (the 3 vols.)* 30 *marks.*

THESE are not books to be read through, but are to be regarded rather as a work of reference. They constitute, as the titles indicate, a minute topographical description of Schleswig-Holstein, and though some attempt is made here and there at generalization, they are for the most part packed with facts and statistics presented in gazetteer form. They may be considered the direct successors of the standard works on the topography of Schleswig-Holstein, brought out by J. von Schröder from 1837 onwards, latterly with the collaboration of H. Biernatzki. These naturally stand first in the list of sources which have formed the framework of the present issue, though later publications of an official and statistical character (including Engelbrecht's valuable atlas illustrating the agriculture and stock-rearing industries of the province), and special works on parts of the area, have also been freely drawn upon. The editor has, however, relied mainly for the detailed information on first-hand data supplied by a large number of correspondents, the collection of which must have involved much industry and perseverance. He regrets that complete equality of treatment has been impossible, owing to the varying quality of the information sent in, and its entire lack in some cases. But this is only to be expected in a work of such magnitude.

The bulk of the volumes is occupied by the systematic description, the separate "circles" being treated of in turn in alphabetical order, while the same order is maintained in dealing with the individual localities within each. A brief summary of the general features of each circle is, however, given. Besides the geographical section (here the individual features and subjects are again dealt with in alphabetical order), the introductory matter includes brief sketches of the history, historic topography, conditions of land-ownership, soil, and agriculture. Altogether the books present, in their 2600 closely printed pages, a vast store of information, such as is probably available for few districts of equal extent, and they must long remain the standard work of reference on Schleswig-Holstein.

It should be mentioned that the Hanse towns of Hamburg and Lübeck, and other enclaves within the province, are included in the Holstein volumes.

Iceland.

'Island in Vergangenheit und Gegenwart. III. Teil. Zweite Reise quer durch Island.' By Paul Hermann. Leipzig: W. Engelmann. 1910. 7*m*.

To those who have read Herr Hermann's account of his first visit to Iceland (Parts I. and II. of the above; cf. *Journal*, vol. 32, p. 164), this record of his second journey will seem less enthusiastic. The impression gained is not, as formerly, that the traveller saw everything Icelandic *couleur de rose*. That he suffered a severe fall from his pony, with serious results, doubtless explains the more sombre effect of his reminiscences. The outward conditions were very similar, the same pecuniary assistance was given by the educational authorities and the same guide accompanied him.

The first part of the journey was by sea round the eastern, northern, and western coasts to Reykjavik. The steamship service from Copenhagen is very severely criticized as inadequate and inconvenient. Too many details are given on the subject, as also with reference to the cost and quality of the entertainment at each place visited. This is admittedly for the use of future tourists, as the opinion is expressed that their number will greatly increase if reform is instituted by the steamship company. From Reykjavik, the route was by way of Kalmanstunga—for the Surtshellir caves—round the Snaefellsnes peninsula, northward to Hrofberg, continuing eastward to Hölur, southward by the Kjölur to Hvitarvatn, Geysir, Gullfoss and Skalholt, and after a *détour* of Reykjanes peninsula again to Reykjavik.

There is much more geological matter than in the author's first volumes, though scientific readers are asked to remember that a layman addresses them. Many hints and much useful advice are given to future geological explorers, and virgin ground is pointed out in various parts of the country.

The political situation is touched upon, the writer's view being that closer union between Iceland and Denmark is outward only: the feeling of the people is the same as before the visit of the Danish king in 1907. The folk-lore of the island is kept well in the foreground, extracts from the sagas connected with each region visited are given, together with much historical information. Herr Hermann also gives the results of his observation—generally appreciative and always interested—of commercial and educational progress, local and national customs, and general conditions. There are numerous photographs and drawings, and a map of the route followed. We share the author's regret when he alludes to his second as his final visit to Iceland, for the picture given is varied, clear, and interesting.

M. G. B.

ASIA.

Syria, Mesopotamia, and Asia Minor.

'Amurath to Amurath.' By Gertrude Lowthian Bell. *Illustrated.* Pp. xvii. and 370. London: Heinemann. 1911. 16*s. net.*

Miss Gertrude Bell explains her use of a familiar quotation for the title of a book of travel in her dedicatory letter to Lord Cromer. But ought it not to have been followed by a note of interrogation? For the underlying idea of the book is doubt whether, despite all present appearances, the "Unchanging East" can really be changed. That question was evidently cropping up for ever in Miss Bell's mind, and she is for ever implicitly putting it to her readers. Travelling, as she did, through the period which covered the first realization of constitutional rights in the Ottoman empire, the counter-revolution of 1909, and the deposition of Abdul Hamid, and meeting and talking with all sorts and conditions of men—Arab, Armenian, Turk, Kurd, Circassian, Yezidi, and Anatolian, Miss Bell collected more original material for forming her judgment on the new Ottoman *régime* than any one else has collected who has written a book. Perhaps that is why she enunciates no judgment at all. If she had known less she would have dogmatized more. As it is, she fears to tread where fools rush in. Politics, however, do not concern the Royal Geographical Society, except in so far as they modify economical conditions, or seem likely to modify them; and we pass therefore, with the remark that there is a good deal in the book which prepares us for future changes in political grouping in the Ottoman empire, to matters more strictly germane to this journal. It may be said at once that Miss Bell is far more interested in archæology than she is in geography, and that she hardly concerns herself with the latter unless it is ancient. Her most important contribution consists in the description of ancient sites on the left bank of the Middle Euphrates, which may be identified with one and another of the Parthian stations—a description which has already appeared in a more severe form in the pages of this journal; but incidentally she gives much new information about the distribution of Arab tribes, and the conditions of life on the least-known side of the river. Her dash southward from Hit to seek and find the amazing ruin of the great palace at Ukheidar took her also over fresh ground; and she has laid topographers, interested in the early history of Islam, under a deep obligation by the work she did at Samarra, and her careful description of that immense field of ruin, soon, it is said, to be explored with the spade by German archæologists. Fresh accounts of the Yezidi sanctuary at Sheikh 'Adi and of the legendary place of the Ark's grounding on the summit of Jebel Judi are very welcome. This book will confirm the impression made on all geographers by Miss Bell's earlier volume, 'The Desert and the Sown,' that she is a traveller of very unusual equipment and address. Fearless, tireless, prepared to use for all it is worth the advantage which her sex gives her among desert Arabs and to a less extent among all Orientals, singularly fluent in Arabic, while not unversed in other vernaculars, she adds to so great qualifications a wide general interest in all vestiges of antiquity, and an exceptional knowledge of Christian and Moslem architecture. Withal she is sympathetic by instinct with all sorts of wild life, and is quickly on terms of cordiality with the most diverse men and women, commanding respect and even admiration wherever she appears. Obviously she can go whither she wills in the Nearer East, and hear and see more than most men can see and hear. A nation of explorers has to reckon with one of its most valuable assets in the person of Miss Bell.

D. G. H.

Travels in South-West Asia.

'Persia and Turkey in Revolt.' By David Fraser. Edinburgh and London: Blackwood. 1910. 12*s.* 6*d. net.*

The author is well known, not only as a correspondent of both the London *Times* and the *Times of India*, but also as an authority of no mean weight on the topics of western Asia generally. In his present volume he reproduces the letters he has written to those journals in 1909 and 1910, and the momentous events of the past two years are undoubtedly well worth being thus recorded, in a form suitable for easy reference. The first part of the author's experiences lies in Teheran, during the earlier days of the Constitutional movement. Thence, *viâ* Kum and Kashan, Mr. Fraser proceeded to Isfahan, after which his route lay through the Bakhtiari country. A very interesting chapter is one dealing with the tract in which the Anglo-Persian oil company has started operations. The ubiquitous smell is graphically described by the author as a compound of paraffin, brimstone, and rotten eggs, and it is an amazing proof of what the human system is capable of being habituated and inured to, that people used to oil-fields are said to become sick when they breathe untainted air and so are obliged to carry a phial of their precious oil to inhale when they go for a holiday. The supply of oil in this region would appear to be almost illimitable. The chapters on the Bakhtiari country and Mesopotamia include reference to the excellent work that has been carried on in the former region by Mr. H. F. B. Lynch, and in the second by Sir William Willcocks, whose magnificent irrigation projects are now attracting widespread attention. Mr. Fraser is inclined to throw cold water on Sir William's project for further developing Mesopotamia by the construction of a railway running westward to the Mediterranean, chiefly on the ground that, as a means of conveying grain, such an undertaking could not compete with the cheaper, though far longer sea route. But it must be borne in mind that a railway from Mesopotamia to the Mediterranean need not subserve the requirements of Mesopotamia alone. It might easily be so aligned as to form part of a trunk railway from the Syrian or Egyptian coast to India, and by reason of its directness would prove the real solution of "the short cut to India." The concluding chapters of the book dealing with Babylon, the Euphrates, the Persian gulf, and Palmyra, are more interesting, from a geographical point of view, than the earlier part of the work which deals with the political events of the two years under review.

Asiatic Exploration.

'Svar på *Tal.*' Af Sven Hedin. Stockholm: Albert Bonniers Förlag. 1910. Pp. 61, 75 *öre.*

The followers of Charles XII. on their return from captivity in Siberia brought with them much information about that country and central Asia. Chief among them were Strahlenberg, who returned to Sweden in 1723, Schönström and Renat. In 1879, August Strindberg rescued their work from obscurity and made them known partly in the periodical of the Swedish Society for Anthropology and Geography, and partly in 'Kulturhistoriska Studier,' 1881. Nothing more was heard of them till last year (1910) when Strindberg has published his 'Tal till Svenska Nationen,' in which he makes the somewhat surprising statements that Central Asia was explored by Swedes in the eighteenth century, that Central Asia and Siberia were then better known than in later times, and that D'Anville stole the material for his map from the Swedish travellers. He also affirms that Prjevalsky traversed, mapped, and thoroughly described all the countries through which Dr. Hedin subsequently travelled, and that the work of the latter was merely a revision. Regarding Lop-nor, he says that Prjevalsky

was not the first European to visit the lake, nor Hedin the first Swede. These and other affirmations of less importance are refuted by Dr. Hedin in this pamphlet. Strahlenberg and Schönström, he says, obtained their information about Central Asia by inquiry, and Renat, who lived among the Kalmukhs, never went so far as Lop-nor.* On the whole, Dr. Hedin's work lay west of Prjevalsky's. A sketch is here given of the well-known Lop-nor controversy, and the change in the position of the lake is certainly confirmed by Renat's map, which, however, is only a copy of a Mongolian original in the library of the Upsala university. Renat's map and the original are here reproduced for comparison.

The Shans.

'The Shans at Home.' By Mrs. Leslie Milne. With two chapters on Shan history and literature by the Rev. William Willis Cochrane. London: Murray. 1910. 15*s. net.*

The authoress visited the Northern Shan states in 1906, and resided at various towns for several months at a time, her chief object being to study the language and trace the origin of a people called the Palaungs, or Pales, who descend from their homes in the hills to trade with the Shans of the valleys, but are not allied to them either in race or language. We are furnished with very full information regarding the Shan people generally, and their mode of living, and the impression is decidedly pleasing. They are naturally sociable, generous, and kind-hearted, and always very hospitable. The climate of the upland plateau of the Shan states is healthy if certain precautions, such as the use of mosquito curtains, are taken against fever. The winters are cool—the mornings from November to February being really cold, the ground often white with hoar frost. Fruit is found in profusion, and the authoress thinks it strange that no attempt has been made to cultivate fruit and make jam, especially raspberry jam, for British residents in the East, whose jam is at present imported from England. The population of the Northern Shan states is at least 370,000, and their position east of Upper Burma makes it not unlikely that when communication is facilitated between Burma and China their country will play an important part in the opening up of the contiguous regions. For this and other reasons, we regret the absence of a map, which would have greatly helped the reader.

China.

'Gleanings from Fifty Years in China.' By the late Archibald Little. London: Sampson Low. 1910. 7*s.* 6*d. net.*

The late Mr. Archibald Little has been truly described as a merchant by the accident of career, but a scholar and traveller by bent of character and patience. Having arrived in China as far back as 1859, his experiences cover a period of nearly half a century, and his widow has undoubtedly done useful service in putting together a collection of interesting fugitive pieces, consisting chiefly of his contributions to periodical literature in China, America, and England. Roughly, these articles may be grouped, in point of subject-matter, into four categories, viz. trade and politics, travel, drama and legend, and religion and philosophy. These are varied and supplemented by an original play, in the Chinese manner, entitled "Plot and Counterplot," and an ancient Chinese farce, called "Browning Boots," neither of which had been published before. A reference to other writings of Mr. Little, and a brief account of some of his

* Dr. Hedin seems to have since modified his views, for in a note in *Petermanns Mitteilungen* (1911, No. 2), following one by Strindberg, he fully endorses the latter's conclusions as regards Renat.

pioneering and general work in China, will be found at p. 629 of vol. 32 of the *Journal* (December, 1908).

'The Lands of Art and Holy Writ.' By Rev. T. W. Fawthrop. (London: Kelly. *N.d.* Pp. 320. *Illustrations.* 3*s.* 6*d.*) This is an account of a tour along part of the Mediterranean littoral and in the Holy Land. It follows well-known lines, and its object is rather to inspire its readers with the enthusiasm generated by first-hand knowledge of the sites of Biblical story than to add to the scientific study of these sites. There are some excellent photographs.

AFRICA.

'The Big Game of Africa.' By Richard Tjader. (London and New York: Appletons. 1911. 12*s.* 6*d. net.*) Mr. Tjader gives a straightforward and lucid account of the big game found in British East Africa, the best methods of hunting, details as to the organization of a caravan, particulars as to cost, and suchlike matters. He also describes the country and the natives in a manner which shows him to be a keen observer. An appendix gives a practical introduction to the study of Swahili, the *lingua franca* of East Africa. Incidentally, we get the author's sporting adventures, pleasantly told. A sketch-map shows the game reserves, and there are many good photographs, chiefly of animals, by the author and his coadjutor Mr. Herbert Lang, a taxidermist.

'Egypt. Ancient Sites and Modern Scenes.' By Sir Gaston Maspero. Translated by Elizabeth Lee. (London: Unwin. 1910. 12*s.* 6*d. net.*) This is a series of papers written at various dates since 1899, giving an account of visits by the author in his official capacity as Director of the *Service des Antiquities* to the principal places on the Nile between Cairo and Philæ. There is no need to dwell upon the high value which attaches to Sir Gaston Maspero's description of the antiquities in his charge. No better guide to them could be desired. He has very skilfully and sympathetically drawn his picture of Egypt as it should be viewed to-day by the tourist. He gives us also the atmosphere of the country, the thoughts of the fellahin, and the sense of the passage of centuries, which, despite the imposition of Greek, Roman, and Arab culture, and the bestowal of new religions, have left the people in essentials (if the power to govern be excepted) little changed since the days of the Pharaohs. The translation has been very well done, and the illustrations are good.

'Five years in the Sudan.' By Edward Fothergill. (London: Hurst & Blackett. 1910. *Illustrations.* 16*s. net.*) Mr. Fothergill went to the Anglo-Egyptian Sudan, in the service of the Government, in 1901. His duties took him chiefly to the upper Nile and the Bahr el Ghazal. He also visited the Sobat, and spent some time on the Blue Nile. His book is largely occupied with sporting adventures and political reflections. He has also criticisms on missionary methods among the pagan tribes. His views are sometimes rather superficial. When dealing, however, with non-controversial subjects he tells us much that is of interest and value, notably concerning the Bahr-el-Ghazal and the Nilotic tribes. There is an illuminating chapter on Belgian methods in the Lado Enclave. Mr. Fothergill's descriptions of the scenery are good. He also makes us realize the daily life of an official—a life of hardship and loneliness unsuited to any one not prepared to work, and work hard, for the betterment of the land and the people. In the last chapter the author describes the material progress made in the Sudan up to 1910, and he closes with a note of optimism about the future of the country.

AMERICA.

The Peruvian Empire.

'The Incas of Peru.' By Sir Clements Markham, K.C.B. With sixteen illustrations and map. London: Smith, Elder. 1910.

For over fifty years the author of this learned and pleasantly written history of Peruvian culture has been almost uninterruptedly associated with Hispano-American affairs, and he may even claim to be a benefactor of mankind by his introduction of the quinine-yielding Chinchona plant into British India from this region. In the present work, which may be described as mainly historical, he has given us a well-digested account of the Peruvian Empire, taking this expression in the widest sense of the term. It thus includes nearly all that can now be known of the two pre-Inca States of Chimu on the west coast and of Tiahuanaco at the south end of Lake Titicaca. An opportunity is thus afforded of dealing with the mound-building Chimus, whose relations lay probably with the cultured peoples of the north (Mayas? Aztecs?), and with the megalithic builders of Aymaraland.

The account of the Incas proper is very full, and nothing better has been written on this subject since Prescott's 'Conquest of Peru,' of which the present work may be regarded as a complement. We have a vivid description of "the land of the Incas, the land of the sovereign city [Cuzco], the land of the sacred vale! The land converted from the home of many contending tribes, to a realm obedient to one king and lord. The land of the Incas was 250 miles in length by 60 in width. It was bounded on its western side by the river Apurimac, 'Chief of the speaking waters,' dashing down a profound ravine with precipitous sides. On the east was the Vilcamayu, 'the sacred river,' flowing from 'the sacred lake' at the foot of the lofty, snowy peak which is visible from Cuzco, rising majestically into the azure sky. Unlike the Apurimac, the Vilcamayu irrigates a wide and fertile valley unsurpassed for beauty in the wide world. To the south this classic land is separated from the basin of Lake Titicaca by the knot of Vilcañeta which connects the eastern and maritime Cordilleras. To the north the wild mountains of Vilcapampa finally sink down into the tropical Amazonian forests."

The sections devoted to the religion, feasts, customs, language, and literature of the *Quichuas*, as the cultured Peruvians were and still are collectively called, are excellently treated, and special attention has been paid to the political and social condition of the people under the Inca administration. Those who are at present so zealously advocating certain communistic systems in Europe and America will here find that analogous principles had already been adopted, and found wanting, by the pre-Columbian rulers of the Peruvian empire. Their subjects formed so many organized groups of which the family was the unit, and which collectively constituted a patriarchal system under the Inca government. There was, strictly speaking, no private property, and the arable land was only temporarily held by the heads of the *Ayllus*, as the several communities were called. Lack of space prevents a detailed account of this purely socialistic *régime* "such as dreamers in past ages have conceived, and unpractical theorists now talk about." It established peace throughout the land, and supplied the people with all their material wants, but brought them under an inexorable despotism which left them unmanned. Hence the whole system fell to pieces at the first shock of the Conquistadores, "and the unequalled fabric disappeared for ever."

A. H. Keane.

'A Systematic Geography of America.' By G. W. Webb. (London: Methuen. 1911. Pp. viii., 108. *Maps and Diagrams.* 1*s.*) This volume, completing the series of five from the same pen, maintains the systematic treatment claimed by the title. The book will, no doubt, be found suitable for examination purposes, as is its stated object, but one hundred pages on the two Americas would perhaps hardly carry the examinee far enough, and whether a work on these lines can be expected to be "of interest to the general reader" is open to question. It is no doubt a matter of opinion, but in this, as in so many school geographies, the attempt to outline the history and governmental system, say of the United States, in a single page, may be considered one that had better have been left unmade. There are some clear distributional and other diagrams.

'Through the Heart of Canada.' By F. Yeigh. (London: Fisher Unwin. 1910. Pp. 319. *Illustrations.* 10*s.* 6*d.*) There is nothing new in this book, but it is a presentable account of the great longitudinal zones of Canada which are crossed on a journey from the mouth of the St. Lawrence to Victoria—the old eastern zone, the prairies, and the mountains. The wording is sometimes florid, but Canadian enthusiasm is justified and infectious.

'Cuba.' By Irene A. Wright. (New York: Macmillan Co. 1910. Pp. xiv. 512. *Map and Illustrations.* 10*s.* 6*d.*) This book is a miscellany, and not an uninstructive one. The writer knows parts of the island well, principally through associations with the local press, which have provided opportunity for intimate study of social conditions among all classes of Cubans, and in this study the chief interest of the book is found. The style will hardly commend itself widely to English taste.

'The Argentine in the Twentieth Century.' By A. B. Martinez and M. Lewandowski. (London: Fisher Unwin. 1911. Pp. liii., 376. *Map.* 12*s.* 6*d.*) This is a translation by Bernard Miall of the third edition of the French work. Its interests are almost wholly industrial and commercial, and in handling them the authors have had the assistance of an ex-Minister of Finance in Argentina, and of divers gentlemen whose authority is of the first class. In view of the intimate economic relations between this country and Argentina the translation is to be welcomed; the book is full of details not easily to be obtained elsewhere, and these are supplemented by copious statistics. It was a pity not to expunge from the map the fact (however obvious) that it has done duty in an earlier work.

'The Argentine Republic.' By A. Stuart Pennington. (London: Stanley Paul. *N.d. Maps and Illustrations.* 10*s.* 6*d.*) English works on the Argentine are surely less rare than the author of this one appears to suggest in his preface. Be this as it may, there ought always to be room for a well-arranged general survey of a country with such wide interests as Argentina, and Mr. Pennington unquestionably writes with a knowledge which, as regards some departments of his subject, is more than usually intimate. The chapters on the flora and fauna represent close study of these branches, and would serve as a guide to further study in more specialized works. The author also shows by copious quotation and detail a wide knowledge of Argentine literature and journalism, and perhaps these two diverse illustrations are sufficient evidence of his encyclopædic knowledge of the country and its people. On the geographical and geological side his interest is apparently smaller, and his first chapter, of physical description, reads a little like a perfunctory exercise. Lightness, and an adequate map and index are qualities which add to the utility of the book as a work of reference.

'Guía del Viajero en la República de Guatemala. [The Travellers' Guide in the Republic of Guatemala.]' By Francisco Castañeda. (Guatemala: Dept°. de Artes Graficas "Electra." 1909. Pp. vi., 272. *Map and Illustrations.*)

This book is arranged in parallel columns giving the text in the native tongue and in an English translation which, to speak frankly, is bad from the first fly-leaf, on which all rights are reserved as to the author's "propriety," to the last page, where errors are quite unjustly attributed at large to the compositors. But the book seems to be most carefully compiled to meet its object, and includes a great deal of information of value to the trader rather than the ordinary traveller.

POLAR REGIONS.

'The Toll of the Arctic Seas.' By Deltus M. Edwards. (New York: Holt; London: Chapman and Hall. 1910. Pp. x., 449. *Map and Illustrations.* $2.50.) It is to be hoped for the authors' sake that the reaching of the North Pole has created a demand for the supply of general works on Arctic exploration which has lately appeared. The present example is a good one in its way. The author caters for the reader with a taste for adventure, and therefore does not attempt a complete survey of the Arctic story, but selects exciting chapters from it. This is not done, however, without method; the various periods and the various directions from which exploration has been prosecuted all find illustration. The author also exercises a reasonable choice in quotation, and, as a rule, writes with restraint, though we have no welcome for "boreal center" as an ornate alias for the North Pole. The American interest, of course, is prominent. After Barents and Hudson, De Long, Tyson, Kane, Greely, and Peary receive the most attention, though several other expeditions are fully dealt with, and those which are not are summarized in a final chapter.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Altitude and Azimuth Tables.

'Altitude Tables, computed for intervals of four minutes between the parallels of latitude 0° and 60° and parallels of declination 0° to 24°, designed for the determination of the position-line at all-hour angles without logarithmic computation.' By Frederick Ball, M.A. Second Edition. 2 vols. London: J. D. Potter, 1910. The same, between the parallels of latitude and declination 24° and 60°. 1909. 15*s. net each vol.*

'Altitude and Azimuth Tables for facilitating and determination of lines of position, and geographical position at sea. The simplest and readiest in solution. Spherical traverse tables for solving all problems of navigation.' By Lieut. Radler de Aquino. London: J. D. Potter, 1910.

Any devices or series of tables for shortening or simplifying the work of computation of the navigator are valuable, provided they are sufficiently accurate for the purpose, can be easily manipulated, and their object is not defeated by the necessity of too much interpolation. Sumner's method or the "New Navigation," as it has been called, has now thoroughly established itself, having been in general use for years past, and many attempts have been made to facilitate the computations preparatory to the drawing of the position lines. Of these, the two sets of tables mentioned above are the latest. The Rev. F. Ball's series give at a glance the altitude of the sun, or other heavenly bodies, for four-minute intervals of hour-angle for each degree of N. or S. latitude and declination up to 60°. A clear explanation of the manner of using them for finding the position line at sea is given, accompanied by examples and diagrams, and the tables themselves are so simple in arrangement that it would be almost impossible to make a mistake in taking out the quantities. The first volume appeared in June, 1907, and included latitudes 31° to 60°, while the second, which appeared two months after, embraced all latitudes between the equator and 30°. A third

volume, covering all latitudes and declinations between 24° and 60°, appeared in 1909. A second edition of the first two volumes was published last year with several additions, such as a traverse table, acceleration table, tables for the correction of observed altitudes, etc., so that no other book should be necessary for working out observations but the Nautical Almanac. Another important addition is the table giving difference of altitude corresponding to 8 minutes' difference of hour-angle from the equator to lat. 60°. Although primarily intended for navigation purposes, Ball's tables furnish a ready means of checking observations taken by explorers on land, or at any rate of preventing them from going seriously wrong with their work. The actual labour of computing the tables, which must have been considerable, has been entrusted to experienced computors at the Greenwich Observatory, under the superintendence of Mr. Crommelin, and the greatest care was taken to ensure accuracy.

The second set of tables is by Lieut. Radler de Aquino, of the Brazilian navy. The purpose for which these have been computed is similar to that which Mr. Ball had in view; but instead of computing the altitude by solving the spherical triangle directly as an oblique-angled triangle, with the latitude, declination, and hour-angle as the known quantities, the solution has been arrived at in this case by letting fall a perpendicular from the position of the heavenly body, and computing the angles and sides in the two consequent right-angled triangles by Napier's rule of circular parts. By this means, owing to the proportion that the various triangles bear to one another, and to the fact that only two terms are required to be known instead of three, the tables are rendered very concise and compact. Other advantages are that they extend to 90° and give not only altitude, but azimuth as well. Still, they take considerably longer time, and are by no means so easy to use as Ball's tables, notwithstanding the great ingenuity Lieut. Radler de Aquino has shown in his method of computation and arrangement, and the pains he has taken to explain their construction and method of use in this introduction, which, by the way, might in some places have been more clearly expressed. The cross references and double headings to the columns are puzzling, at least at first, and then a certain amount of computation is necessary, all of which tends to do away with simplicity, which after all is the chief merit of works of the kind. However, there is no doubt that these tables will be found useful when their arrangement and manner of working has been once mastered.

E. A. R.

The Atlantic Ocean.

'Segelhandbuch für den Atlantischen Ozean.' Hamburg: L. Friederichsen & Co. 1910. 20*m*.

This work of nearly 600 pages, issued by the Deutsche Seewarte, is based on observations contributed by numerous navigators, past and present, principally by those under the German flag; and is admirably arranged.

It forms a concise book of sailing directions for the whole Atlantic; and the carefully edited information is naturally grouped into two main sections which deal respectively with the physical condition of that ocean, and the application of the knowledge of these conditions to the determination of the best routes from port to port. By the aid of the data given in this work the seaman may shape his courses with a view to securing a maximum of advantage with a minimum of risk in conformity with the limitations imposed upon him, either by the normal conditions of the seasons or by the environment of the ports of departure and call. The seventy-nine diagrams interspersed through the body of the work, together with the six plates introduced immediately behind the

copious index at the end of the volume, assist the reader materially in following the recommendations given in the letterpress as aids to safe navigation.

Included in the first section, which may be broadly termed theoretical, are nine clearly compiled chapters or books, which, taken as a whole, form a compendium of oceanography for the Atlantic. These chapters give detailed descriptions, respectively, of the greatest depths of the Atlantic; the nature of the deposits on the ocean bottom; the specific gravity of the sea; its temperature at the surface and at varying depths; the set and drift of the surface currents; the frequency and distribution of icebergs and other forms of drifting ice; and the height of waves as recorded by seamen navigating the Atlantic.

A general review is then given of the wind circulation known to prevail over the open ocean; the conditions of wind and weather off its coasts from the Far North to the latitude of Cape Horn; the temperature and humidity of the air; falls of red dust in the Atlantic near the west coast of Africa; the cyclonic storms of that ocean; its tides; also the magnetic variation.

In the first section of nine chapters, 287 pages in all, the storms of the Atlantic, from birth to death, are especially dealt with. A chapter, opening with a general exposition of atmospheric disturbances, goes on to define the special characteristics of the various forms of disturbance which are germane to the several parts of the ocean. The second part of this volume comprises twenty-three chapters of 267 pages, in each chapter of which information is given regarding the best tracks to be followed on the various routes according to the time of year. It indicates, in fact, the application of the principles enunciated in the first section. Information is furnished relating to wind distribution; sea surface currents; ice; fog and mist frequency on the various routes beginning with those in high latitudes of the North Atlantic, followed by others across different zones of that ocean. Sailing directions are laid down for passages to and from the equator, the Cape of Good Hope and Cape Horn, Europe and the east coast of North America; between the Cape, England and the east coast of South America; between Europe and North America and the west coast of Africa, the West Indies and north coast of America; and between Cape Horn and the east coast of South America. The whole work should appeal to the seaman who is eager to make quick and successful Atlantic passages.

M. W. C. H.

Coral Reef Formation.

'Coral and Atolls, their History, Description, etc.' By F. Wood-Jones, B.Sc. London: Lovell, Reeve & Co. 1910. 24*s. net.*

Under the above somewhat broad title we have a work mainly devoted to the Cocos-Keeling atoll. The author passed some fifteen months there in medical charge of the cable station which lands at Cocos-Keeling on its journey from Africa to Australia. Cocos-Keeling atoll and Christmas island lie well out from the Malay archipelago, and are of peculiar interest in being the only two purely oceanic islands in this eastern part of the Indian ocean. The latter, which is of elevated limestone, has recently been made well known to us by the researches and publications of Dr. C. W. Andrews, and now Mr. Wood-Jones gives us a full account of Cocos-Keeling.

The atoll is one which has been visited and to some degree investigated by Darwin, Guppy, and Forbes, but none of them spent the time on the atoll that Mr. Wood-Jones has done. However, Darwin largely founded his theory of coral-reef formation on his investigations there, and now Mr. Wood-Jones tests that and most other theories of the same by his researches in the same atoll.

There are always obvious dangers in generalizing from one locality, but this further account of Cocos-Keeling after a lapse of over half a century will always be interesting. To complete it we should have liked to have seen a large chart of the atoll, either a copy of the Admiralty Chart, if sufficiently recent and detailed, or else a new plan.

After dealing with the settlement of the islands of the atoll by the Cluniés-Ross family, and their subsequent history, a story of great human interest, the author plunges into an account of the natural history of the coral animals from birth to death. It is of interest, as it contains many new observations, and it is appropriate here, as the reader must have some acquaintance with the growth of corals before he proceeds to study the formation of reefs. Accounts of the atoll, its reefs, islands, and lagoon, follow, as well as of the climate and winds. In passing, some of the theories put forward to explain the formation of reefs and atolls are mentioned, with a few observations thereon. More important are the author's own conclusions. "*Somewhere* in the ocean there is a level, below which particles may rest and sedimentation take place, and above which particles are prevented from settling by the movements of the surface waters." The italics are the author's. To this level the name of the "Limiting Line of Sedimentation" is given. The author lays it down as a law that "*the bathymetrical limit of the reef-building corals extends to the limiting line of sedimentation.*" Reefs are raised up by the agencies of living coral colonies. Broken corals accumulate and begin to form the barrier. "*The shape of the group, the shape of the atoll, and the shape of the individual islands is impressed by the agency of the normal winds and waves; and the stimulus of origin and the increments of building are the outcome of the exaggerated violence of the normal winds and waves.*"

It is scarcely fair to attempt to summarize an author's conclusions in a few necessarily short quotations, but the above perhaps indicate Mr. Wood-Jones' trend of thought. The style of the book is free and most readable. It contains much of value and much which will probably be criticized. It may be read with advantage by all interested in coral-reef formation. A last section dealing with the flora and fauna of Cocos-Keeling is of less interest to geographers.

J. S. G.

THE MONTHLY RECORD.

THE SOCIETY.

The Awards for 1911.—With the approval of His Majesty the King, as Patron of the Society, the royal medals have this year been awarded as follows: The Founder's Medal to Colonel P. K. Kozloff, the well-known Russian explorer of Central Asia. From 1883 to 1896 he accompanied expeditions under Prjevalski, Pjevtsoff, and Roborovski, taking an important part in the exploration of the Gobi desert, northern Tibet, the Tarim basin, Turkestan, and Dzungaria. In 1899–1901 he was himself leader of an expedition to Mongolia and the almost unknown highlands of north-eastern Tibet, while during his latest expedition, only recently described in this *Journal*, he covered a large area in Mongolia and northern Sechuan, bringing back, as on previous occasions, valuable scientific results in various departments. The Patron's Medal is given to Dr. J. B. Charcot, for his important expeditions to the Antarctic in 1903–1905 and in 1909–1910, during which he made valuable additions to our

knowledge of the Antarctic area lying south of South America, giving much greater precision than existed before to the outline of Graham Land and its extension to the south and south-west, including the various outlying islands. With the aid of expert coadjutors, he has conducted investigations of high scientific value into the geography, geology, meteorology, magnetic conditions, and biology, of the region explored. The Victoria Research Medal has been awarded to Captain H. G. Lyons, F.R.S., for many years Director-General of the Egyptian Survey Department, from which he recently retired in order to devote himself to scientific research in geography. Among his more important services during his tenure of office was the execution of the cadastral survey of Egypt. Many important scientific memoirs were issued by his department, including his own volume on the 'Physiography of the River Nile and its Basin,' recognized as the leading authority on the subject. The other awards are given as follows: The Murchison Bequest to Dr. Wilfred Grenfell, for his many years' work in Labrador, during which he surveyed a large extent of coast-line, and added in other ways to our knowledge of the geography, people, and resources of that region; the Back Bequest goes to Dr. Arthur Neve, who during a long residence in Kashmir has made important contributions to a knowledge of the physical geography and glaciology of the Himalayas; the Cuthbert Peek Grant to Mr. R. L. Reid, for his careful mapping of the Mobangi river and adjoining areas in the north-east of the Belgian Congo; and, lastly, the Gill Memorial to Captain G. E. Leachman, for the journey in north-eastern Arabia described in the March number of the *Journal*, during which he completed a survey of a difficult region not visited by Europeans for some twenty years.

EUROPE.

The Geology of the Ingleborough District.—A 'Guide to the Geological Model of Ingleborough and District,' by Dr. Aubrey Strahan, has recently been issued as a Memoir (1910) of the Geological Survey of England and Wales. It contains a photograph of the model, and the text, descriptive and explanatory of the geology of the Ingleborough district, is illustrated by a clearly defined coloured geological map. The three main divisions of the sequence of rocks comprised in the Carboniferous system forming the great Pennine uplift of the north of England are, downwards—the Coal Measures, the Millstone Grit, and Limestone series. The highly dissected plateau of the district consists of alternations of shales, sandstones, and limestones (Yoredale Beds) based upon 600 feet of solid limestone, known as the Great Scar Limestone. The Coal Measures and Millstone Grit formations which occur on the Pennine flanks have, as is well known, been denuded away from the summit of the range, and so deeply have the exposed Yoredale Beds been dissected that they have been cut up into outliers, while the Great Scar limestone has been laid bare in the form of a terrace upon which these outliers stand. In some places the dissection has gone to such a depth as to expose the ancient platform of Silurian rocks upon which the Great Scar limestone itself rests. On Ingleborough there is a little platform composed of a small relic of Millstone Grit, and a great shoulder of the hill is formed of Yoredale sandstones. The Yoredale shales

are weathered into the characteristic cwms of the district, while the more resistant limestone stands out in broad surfaces. Within the area illustrated by the model we have records of Earth-movements of two distinct geological periods. The first, of pre-Carboniferous age, was a period of intense compression, resulting in folding, cleavage, upheaval, and consequent denudation; the second, of post-Carboniferous age, brought about the series of fractures known as the Craven, Dent, and Pennine Faults. The glacial records, the river system, and the caves for which the Ingleborough district is so famous are further dealt with in the memoir. "There are few places in the kingdom," says Dr. Strahan, "where the caves and underground water-channels, characteristic of limestone formations, can be studied to greater advantage than round Ingleborough." We would add that the play and force of water in this district are positively wonderful. During heavy winter rains or the melting of deep snows, or occasionally during the midsummer period when thunderstorms brood among the darkened fells with a violence and persistence more intense than in most parts of England, filling the dales with a turbulent race of flood-water, the streams which in drier times tinkle away through "pot" and cave and tortuous little subterranean passages, surge above ground and ride furiously away Ribblewards or Ousewards, to the western or the eastern sea. There is something, so it seems to us, peculiarly stimulating to mind and body in the scenery of a true limestone country, and this desolate weather-beaten Pennine backbone of England forms no exception, widely though it may differ from the sunlit limestones of Greece and other southern climes.

A Ship Canal for Paris.—An agitation in favour of making Paris a seaport by the construction of a ship canal appears to be gaining strength in France. The present position of the question is concisely summarized in the supplement to the *Tour du Monde* for February 25, 1911, on the basis of an article by M. Blanchon in the *Revue hebdomadaire*. It is pointed out that though Paris is as a rule left out of count in dealing with the ports of France, it in reality stands at the head of the list according to the official figures for the movement of merchandise through it. These were, for 1907, 12,744,000 tons, as against some 7,265,000 tons credited to Marseilles in 1908. Were the figures for the lesser ports on the Seine and elsewhere, which must be regarded as strictly tributary to Paris, added, the total would be raised by over 3,000,000 tons. Further, a considerable proportion of the trade of Havre, Rouen, and even Antwerp, is held to naturally fall within the sphere of influence of Paris, and it is reckoned that, once made accessible to ocean vessels, the capital might command a trade of some 20,000,000 tons. By its position as the focus of the industrial life of France, Paris would, it is maintained, possess unique advantages as a port; whereas, should the present position be maintained, the city would soon share with Vienna and Madrid alone, among the great European capitals, the unenviable distinction of having no direct communication with the sea. The actual scheme proposed was due in the first instance to the late M. Bouquet de la Grye. It provides for the canalization of the Seine between Paris and Rouen, with the addition of two insignificant cuts across the most pronounced bends of the river, by which, besides shortening the distance, interference with the railway at those points would be obviated. The main port of Paris would be between St. Denis and Clichy, and the total distance of 185 kilometres from Rouen would be divided into five sections by four locks, giving a total rise of 21¾ metres (71 feet). With the proposed depth of 7·20 to 8 metres (23½ to 26 feet), the cost is estimated at from 200 to 300 million francs (8 to 12 million pounds), including necessary deviations of the railway, high-level bridges, etc.

A suggested extension of the scheme is that of a canal connecting the Marne with the Seine below Paris, by which the danger of destructive floods would be much reduced. Opposition to the scheme is not wanting, but it has at least reached the stage of serious public discussion.

The Plain of Lorraine.—M. Auerbach's excellent study of a region of France, brought out in 1893 under the title 'Le plateau Lorrain' (cf. *Journal*, vol. 2, p. 52), has taken an assured place as an example of the way in which such a regional investigation should be carried out. While it dealt in turn with each of the natural regions, following each other from west to east, of which the whole is made up, another writer, M. Gaston Gravier, has lately taken a portion only—that locally known as "La plaine"—as the subject of more detailed consideration on much the same lines (*Annales de Géographie*, November 15, 1910). The "plain" of Lorraine forms the central zone of that region, lying between the Vosges on the east and the limestone plateaux, bounded by the Jurassic escarpment, on the west. But while thus relatively a low-lying area, in its surface, climate, hydrography, and other features, it is far from being a homogeneous unit, such unity as it does possess being derived rather from the strong contrast which it displays with the neighbouring regions. Geologically, though mainly composed of two distinct zones—those of the Trias and Lias—it is marked by the rich variety of its rocks, though these possess the general character of friability, and show a predominance of the calcareous element. It is this multiplicity and rapid alternation of rocks within a small compass which has much to do with the marked fertility of the plain and its resulting character, maintained throughout its whole history, of a distinctly agricultural unit. This character is to be seen everywhere in the social organization, which, apart from the Moselle valley, is typical of an agricultural community. Within the plain, some amount of variety in the methods and objects of cultivation, in accordance with local differences of soil and relief, is to be observed. Thus it is on the zone of the Lias that the cultivation of corn can be carried on with greatest success, while certain zones, especially that of the sandstone at the base of the Lias, possess their forests with the associated industries, though to nothing like the same extent as the regions to the east and west. Cattle-rearing, too, has made some advance within recent years. The valley of the Moselle crosses the plain diagonally, forming a sort of link between the "mountain" on the east and the "plateau" on the west, but the great industrial development which has taken place in this valley within recent years is virtually limited by the valley walls, and the life of the agriculturists on either hand is still untouched by it, except in so far as it offers a handy market for their produce. The extent to which this is the case is shown by the fact that only eight centres have a population exceeding a thousand.

The Exploration of Macedonia.—A committee has been formed, with Dr. Arthur J. Evans as chairman, for the promotion of research in the Balkan lands, for which the present time is held to offer particular advantages. A circular has been issued explaining the objects of the committee, and appealing for subscriptions to a "Macedonian Exploration Fund," which may be sent to the treasurer, Vincent Yorke, Esq., the Farringdon Works, Shoe Lane, London, E.C. It is pointed out that Macedonia holds the key to many problems, as being the medium through which successive northern invaders entered Greece, and (at a later date) Hellenic culture passed into Central Europe. The field of inquiry will be a wide one, covering not only the excavation of sites, but the study of political, social, and economic customs and institutions which have survived from earlier times, the detailed surface exploration (geographical and

topographical) of the district, and the investigation of the monuments of all periods. During a first campaign, the committee proposes to excavate an early site near Salonica, in a district where historic and prehistoric settlements are contiguous. It is to be hoped that adequate support may be forthcoming for so important an undertaking.

AFRICA.

Uganda Topographical Survey.—On the advice of the Colonial Survey Committee, it was decided to send out a military party to carry out the topographical survey of the "Kingdom" of Uganda. About 3400 square miles had already been topographically surveyed by the Uganda Survey Department, under the direction of Mr. R. C. Allen, but the requirements of the native settlement survey and other pressing duties prevented the Department from completing the topographical survey. The topographical survey party, which worked independently of the Survey Department, was put under the command of Captain W. C. Macfie, R.E., who was assisted by the late Lieut. W. D. Pennington, R.E., and six R.E. non-commissioned officers. The party arrived in Uganda in February, 1909, and were at work in the country for nineteen months, at the end of which period the approved programme was completed. During these nineteen months the party surveyed 14,000 square miles on the scale of 1 : 25,000. Sad to say, of this small band of two officers and six non-commissioned officers, one officer, Lieut. Pennington, and one non-commissioned officer, Corporal Corner, died from the effects of the climate and the exacting work. The survey is of exceptional interest, as it completes the first accurate topographical survey of any considerable block of country in tropical Africa. The 14,000 square miles mentioned above, added to the 5400 square miles executed by the Survey Department, and to the 3400 square miles of the Lake Kioga Survey of Lieut. C. E. Fishbourne, R.E. (for which he received the R.G.S. Cuthbert Peek Grant in 1910), added also to the neighbouring international boundary surveys of Colonel Delmé-Radcliffe and of Major Bright, and a special survey of Major A. G. Stevenson, R.E., complete a connected area of accurate topographical survey of no less than 32,000 square miles. The maps are in course of preparation, and it is hoped that they will be published at an early date. The publication will be awaited with interest.

The Liberian Frontier.—The accompanying map shows the Liberian frontier as settled by recent agreements with France and Great Britain, a question which has been the subject of recurrent negotiation during the last twenty years having thus at last been set at rest. The first arrangement, concluded in 1892,* had greatly reduced the area of the Republic as against the somewhat vague claims set up before that date, and a further curtailment resulted from the agreement of 1907 (*Journal*, vol. 31, p. 105). The process has now been carried still further, though even so, complaints have been made in France that Liberia has been treated with undue generosity in view of the fact that no attempt to exercise control over the interior districts now recognized as Liberian has ever been made by the latter Government. The result of the readjustment of the frontier with Sierra Leone, arrived at in January of this year, is also shown on the map. By this the territory of Kaure Lahun, already occupied by Great Britain on account of the failure of the Liberian authorities to maintain order therein, has been ceded by the Republic in exchange for a slice of territory south of the Morro river, which now becomes the boundary. The Kaure Lahun

* Some account of this arrangement, and of the previous territorial development of Liberia, was given by Dr. Rouire in the *Annales de Geographie* for 1894 (p. 489).

territory is of some importance to Sierra Leone from a commercial point of view by reason of its proximity to the head of the Sierra Leone railway. The Liberian frontier on this side had previously depended on the agreement with

Great Britain, concluded in 1885, and carried into effect by the delimitation of 1903 (*Journal*, vol. 24, p. 427, with map).

AMERICA.

American Researches in Labrador.—We referred in the December number (p. 733) to a journey made last year across central Labrador by Prof. L. B. MacMillan, who was spoken of as having led the party. This, the traveller now

informs us, was not correct, as his position was rather that of an invited guest than leader. The trip was organized by Mr. W. B. Cabot, of Boston, who has undertaken several expeditions into this part of Labrador from 1903 onwards, and the other members were Mr. Seaville Clark and Dr. G. P. Howe, no native guides being employed. Starting from a point some 55 miles north of Davis inlet, the travellers made their way across the height of land to the George river, this being apparently the first traverse from the coast to the George effected by a white party south of Nachvak fiord. The route followed the Assiwaban river for 60 miles, rising then to the plateau by a difficult climb of 1100 feet, and passing through about twenty lakes with portages between to the George. As there are almost no paths over the portages, the journey involves arduous work, while the number of lakes and ponds makes the route an intricate one. The height of land is 1600 feet (by aneroid) above sea-level, and lies 4 or 5 miles east of Mistinipi lake. The hills here rise in low rounded ridges, glaciated and covered with white moss, but with little soil. Some wood is to be found in sheltered places. No movement of caribou had occurred in 1910, and few were to be seen. Indians were met on the Kanekauch lakes near the George, and also at Ishinutivish hill on Barren Ground lake. A fine new lake, called Mistastin, some 12 miles long by 6 or 7 miles wide, was visited on August 15. Another American expedition was at work last year in Labrador, considerably further south and west. It consisted of Messrs. R. McFarland, T. C. Brown (geologist), and P. Swett (magnetic observer), the first of whom gives an account of the expedition in the *Bulletin* of the Geographical Society of Philadelphia for January, 1911. The starting-point was Pointe Bleu, on Lake St. John, 200 miles north of Quebec by rail, and the party followed the canoe route up the Chamuchuan, Chigobiche, and Nikaubau rivers to the height of land, descending on the northern side by three large lakes to the southern end of Grand Lake Mistassini. Between Lake St. John and the height of land there are many interesting features. The Chamuchuan contains many falls and rapids, rendering the ascent a matter of difficulty. At the lower end of Bear portage the banks are over 100 feet high, formed of clay, overlaid by sand. Above, the river is nearly on a level with the surrounding country. The Laurentian highlands cross the river at the Pimonka rapids, where the clay and sand are replaced by solid rock. The northern branch, known as the Chief (R. du Chef), should be considered the main stream, as it is far larger than the western arm which flows from Ashuapmuchuan lake. The height of land between this river system and the Nottaway is of the nature of a plateau about 1200 feet in altitude, with small hills rising above the general level. Beyond, the route leads by other lakes to the twin lakes Mistassini. Although its outline is fairly well known, no attempt has yet been made to chart the numberless islands in the Grand lake, a chain of which down the middle really divides it in two. The region around is well wooded, trees being seen of greater height and diameter than any passed on the way up. A view obtained from Porcupine mountain gave a general idea of the country, the height of land being conspicuous as a well-defined highland running north-east, several hundred feet above the general level. To the west of the Grand lake, White Bear mountain was a conspicuous object from the lake itself. On the return journey the height of land was crossed some 60 miles to the north-east of the first crossing.

Advance of a Glacier in the Patagonian Andes.—The December number of the *Zeitschrift für Gletscherkunde* (1910) contains a paper by Dr. R. Hauthal on the recent striking advance of the Bismarck glacier, one of the great ice-streams which flow down the eastern side of the Patagonian Andes towards the

upper branches of the Lago Argentino, just south of 50° S. This advance is the more remarkable as all the other glaciers of the neighbourhood, which are fed from the same fields of *névé*, have lately been in marked retreat. The Bismarck glacier (which debouches transversely to the southern arm of Lago Argentino) was so named by Dr. Hauthal, who visited it in 1899 and 1900. In the former year its lower end had pushed out across the lake in a tongue 2 miles wide, and terminated not far from the opposite shore in a wall of clear ice over 100 feet high. The second visit, in 1900, showed that it had already advanced 140 metres at its extreme point, while all the indications of a strong downward thrust of the ice were visible in the rock-masses pushed up the slopes at the side, the turning up of the morainic material as by a plough, and in the glacial striæ directed perpendicularly to the axis of the glacier, showing that a pressure had been exerted from within outwards in all directions (a characteristic of an advancing glacier). A visit paid to the same spot in 1908 by Dr. Quensel, of the Swedish expedition to Patagonia, showed that the advance had been fully maintained down to that year, the snout having approached at least 500 metres nearer the opposite shore than its position in 1899. Information received by Dr. Hauthal from persons who visited the glacier about 1880 showed that at that date the snout had occupied a still more advanced position, the lake being quite barred by the glacier. This state of things must therefore have been followed by a period of retreat occupying some twenty years, while if the recent advance is maintained until the ice once more reaches the opposite shore, the forward movement will have occupied about the same period. The causes of the phenomenon, and especially the different behaviour of so closely neighbouring glaciers, cannot yet be explained, and Dr. Hauthal urges the importance of further detailed research on the spot. The different phases are well illustrated by photographs taken by the author and Dr. Quensel.

AUSTRALASIA AND PACIFIC ISLANDS.

A New Theory of the Discovery of Australia.—The uncertainty attaching to the first discovery of Australia renders the subject of a fertile field for hypothesis and conjecture, and appears to give it a perennial interest to the inhabitants of that part of the world. Unfortunately, the theories put forward in somewhat quick succession have hardly been such as to stand the test of impartial examination, and we fear that the latest, due to Mr. E. A. Petherick, now official archivist to the Commonwealth Government, forms no exception. It is only fair to that gentleman to state that the publication of his theory in the *Sydney Morning Herald* of January 19 was unsought by him; but all the same he professes himself fully convinced of its truth, and now that the question has been brought before the Australian public (it was the subject of a leader in the Melbourne *Argus* on January 21), it is to be feared that it will be debated with no less persistence than has been the case with the equally venturesome theory of Cardinal Moran. Mr. Petherick believes that Australia was discovered in 1499, and by no less a person than Amerigo Vespucci! The idea first suggested itself to him on reading Peter Martyr's account (in his first 'Decade,' book 9) of the giant trees and marsupial animal found during the voyage of the Pinzons to South America in 1499, a specimen of the latter being brought back to Spain. Imagining that this must have been a kangaroo, he became convinced that a voyage to Australia was performed in that year, and has found confirmation, firstly, in the well-known Paris globe of about 1535, which states that the southern continent had been found in 1499; and secondly in the Cracow globe, brought to light by Dr. Estreicher (*Journal*, vol. 18, p. 220), on which a land bearing the legend "America noviter

reperta" figures in the Indian Ocean. The connection of Vespucci with this supposed discovery seems to rest, if possible, on still slenderer grounds. After being absent from Spain (Mr. Petherick says) in 1498 and 1499, both he and Diogo de Lepe appeared at Lisbon with a view to organizing a new voyage, and this is thought to show that the two navigators had already made a voyage "to the Eastern or Portuguese hemisphere"; though as Brazil fell within the Portuguese sphere it is difficult to see why the East alone could fulfil the supposed condition. The theory, it will be noted, involves the summary rejection of everything in contemporary records which does not happen to square with it. Thus, besides transferring the finding of the marsupial from South America to Australia, and assigning it to quite another voyage than that with which it is connected in the 'Decades,' Mr. Petherick regards Vespucci's own accounts of his voyages as "spurious and unauthentic," * and ignores the scanty data which exist regarding Lepe's voyage of 1499–1500. Such a handling of the evidence is, moreover, quite gratuitous. The description of the marsupial (an animal with fox's snout, bat's ears, monkey's hind feet and tail) fits one of the South American opossums far better than the kangaroo, the epithet "monstrosus" being evidently used in its primary sense of something out of the common, without special reference to size.† It is, besides, most unlikely that a kangaroo should have survived the greater part of the protracted voyage from Australia. The legend of the Paris globe is far more likely, as supposed by Harrisse, to have reference to Magellan's voyage (it is placed almost in the position of Tierra del Fuego), and in any case proves little when we think that almost any far southern discovery would in those days be referred to the supposed southern continent. Lastly, Mr. Petherick is hardly consistent in taking the land on the Cracow globe (definitely named America) to be necessarily Australia, when he has himself argued that the southern land of the Desliens-Desceliers maps (still more nearly in the position of Australia) is but a duplication of South America.

The German-Dutch Boundary Expedition in New Guinea.—The completion of the work of this expedition was recorded in the February number (p. 216). A despatch from Dr. Schultze, printed in the *Deutches Kolonialblatt* for February 15, makes it now possible to add some details as to the experiences of the Commission during the ascent of the Kaiserin Augusta river, September to November, 1910.‡ After the limit of navigation by the gunboats had been reached, the two parties went on in boats, assisted for a time by two small steam launches. After some difficulties the longitude of 141° 12′ E. (*i.e.* only 12′ east of the boundary) was reached on October 3, in 4° 4′ 18″ S., and here a camp was formed. An attempt to push northwards towards the point reached by the previous land expedition along the 141st meridian (*Journal*, vol. 36, p. 498) proved unavailing, the country presenting the same character of a level swampy plain as had hindered an advance from the north. It was therefore decided to turn south, and continue the exploration of the upper Sepik (as the Kaiserin

* That Vespucci's statements are untrustworthy may well be the case; but if so they err on the side of exaggerating the Florentine's merits, rather than of concealing such an achievement as the discovery of Australia would have been.

† That the animal cannot have been particularly large is indicated by Peter Martyr's statement that the body was "turned over and over" (Eden's translation of "convoluisti") when examined.

‡ The preliminary reconnaissance (*Journal*, vol. 36, p. 734) was carried out by Lieut. Rambonnet (*Tijdschrift K. Nederl. Aardr. Genoots.*, 1910, p. 1246).

Augusta river is named by the natives) in boats. On October 20 a rocky defile by which the river makes its exit from the mountains was reached, and it thenceforward bore the general character of a rapid shallow stream, only navigable by the light-draught Dayak canoes. It unexpectedly proved to come from the east of south, or from within German territory, being thus hardly suited (except for a short distance) to serve as part of the international boundary. It was traced with considerable difficulty to about 4° 49′ S., 141° 15′ E., when, the north-west monsoon having set in with violence, and the rise of the river threatening to cut off a retreat, it was found necessary to begin the return journey. While the Dutch party undertook the survey of some of the tributaries, the Germans effected the ascent of one of the peaks in the neighbourhood of the turning-point, so gaining for the first time a general idea of the configuration of the country traversed. Towards the west the view extended as far as Mount Juliana, in the central Snowy range. The Sepik had been ascended a distance of 960 kilometres (600 miles), and, at the farthest point reached, appeared to come from the direction of the Victor Emmanuel range.

Exploration in British New Guinea.—The news has reached this country of the return of the exploring expedition under Mr. Staniforth Smith, for the safety of which some fears had been expressed. From the few details to hand, the expedition seems to have covered a large area of quite unknown ground drained by the great rivers debouching into the Gulf of Papua, and important additions to knowledge may be anticipated.

POLAR REGIONS.

Japanese Antarctic Expedition.—The *New Zealand Times* of February 9 and 10 supplies some details as to the equipment and plans of Lieut. Shirase's party, then making their final preparations at Wellington before sailing for the Antarctic. Their ship—the *Kainan Maru*—is a schooner-rigged wooden vessel, 108 feet long, lately strengthened by a three-inch sheathing and quarter-inch iron plates, and is said to have given the impression of being adequate to her task. A strongly built boat is being taken for use in loose ice. The expedition numbers twenty-seven all told, but the southern party will consist of eleven only. Six sledges are being taken, but of a total of twenty-six Manchurian dogs only twelve remained alive when New Zealand was reached, so it appears that the brunt of the work of hauling them will fall on the men. The explorers (whose physique made a favourable impression) do not intend to make any great change from their ordinary diet, rice being largely relied on, though canned meat and vegetables were taken on board at Wellington. Complete suits of bearskin will be worn over woollen garments. Lieut. Shirase proposed to sail direct to Biscoe bay or King Edward VII. land, which he hoped to find free from ice to a later date than McMurdo sound. The voyage was expected to occupy a month, the ship then returning to refit at Sydney. The passage from Japan to Wellington had lasted from November 29 to February 8, but it had been made almost entirely under sail. The scientific equipment appears to be scanty.

GENERAL.

Oxford School of Geography.—The report for the year 1910 has lately been issued. The Committee regret to report the resignation of Sir Clements Markham, to whom the University owes much for his efforts to promote the teaching of Geography in Oxford during quarter of a century. Since the School of Geography was founded in 1899 Sir Clements has constantly come to the Committee meetings, and his enthusiasm and advice have been of the greatest stimulus and assistance to the Committee and to the Staff of the School. The urgent need of additional

accommodation for the school has been met for the time being through the generosity of Sir Abe Bailey, who has provided a sum of £250 a year for five years for the rent and upkeep of Sir Henry Acland's house, 39–41, Broad Street, where special facilities will be given for the study of the geography and history of the Empire. This generous gift will permit the storing of the existing collections of the School in a proper manner and make them more accessible. The library and the collection of large-scale reference maps (now nearly 10,000 sheets) have been removed to Acland House, where a general reading-room has been opened, and seminar, tutorial, and research rooms have been furnished. There is still, however, an urgent need for an endowment for the teaching of geography in the University. It having been found necessary to secure the services of a junior demonstrator who could also act as Librarian, Mr. O. G. S. Crawford, B.A., Keble College, was appointed. On January 25, 1910, by Decree of Convocation, Mr. Herbertson was constituted Professor of Geography as long as he held the office of Reader in Geography. The number of those devoting most of their time to geography increased from 34 in the previous year to 42 (19 men and 23 women), though all of them did not spend three terms at the School. The total number of students on the roll was 70, 58, and 48, in the three terms respectively, while in the present term there are 94 students on the roll. The Decree of B.Sc. was awarded to Mr. F. B. Vrooman, after public examination, the subject of his thesis being 'The Economic Geography of North-West Canada, with special reference to the Agricultural Possibilities.' The Diploma in Geography was awarded to 9 candidates (with distinction, in four cases), and the Scholarship for 1910–11 was awarded to B. W. Baker, B.A., University College. Exclusive of sums spent on furnishing Acland House, over £1810 have now been spent on fittings, instruments, books, maps, lantern slides, views, etc., and in addition many gifts have been received, for which the Committee expresses its thanks. The total addition to the book and map collection for the year is 495 books and pamphlets, and 455 sheets of maps. There is a special report on the very successful Vacation Course held in August, 1910, at which 254 students, mainly teachers of geography, were present.

Universal Races Congress.—Arrangements have been made for the holding in London, on July 26–29 of this year, of a first Congress for the consideration of problems connected with the mutual relations of the great divisions of mankind. Briefly, its objects are stated to be "to discuss, in the light of modern knowledge and the modern conscience, the general relations subsisting between the peoples of the West and those of the East, between so-called white and so-called coloured peoples, with a view to encouraging between them a fuller understanding, the most friendly feelings, and a heartier co-operation." A strong executive committee has been formed, with the Hon. W. Pember Reeves as chairman, and the support of a large number of prominent administrators, ethnologists, and others interested in the subject from all parts of the world, has already been secured. A number of papers have been promised, and a programme of proceedings has been drawn up, grouped under eight main headings. It is also proposed to hold an exhibition under the direction of Dr. A. C. Haddon. The fee for active membership will be twenty-one shillings, or its equivalent in foreign money, which will entitle the member to all publications. The Hon. Sec. of the Congress is Mr. G. Spiller, 63, South Hill Park, Hampstead, who will send a prospectus on application. Good results may be anticipated from the meeting, at which this Society will be represented by Sir Harry Johnston.

The Tenth International Geographical Congress.—We have received from the secretary to this Congress a statement containing a few additional

items of information beyond those given in the first circular (*Journal*, vol. 36, p. 107). After recalling the general constitution of the Congress and the rules regarding representation or participation in the Congress, it is pointed out that delegates from institutions or other bodies are not excused payment of the member's subscription. Those intending to take part in the Congress are asked to send in their names *as soon as possible*, accompanied by the amount of their subscription (25 fr. for "effective" members, 12.50 fr. for each member of their family) to M. l'avocat Felice Cardon, 102, via del Plebiscito, Rome. Abstracts of proposed communications, not exceeding a printed page in length, are to be sent to the Organizing Committee, at the same address, *before April* 30. A detailed prospectus of reduced fares on the Italian railways, and any other information needed, will be sent on request. A choice is offered (during the Congress) of joining an excursion to the Monti Albani, or of visiting the monuments and antiquities in the city, while a series of excursions—a programme of which is being prepared—will take place immediately after the meeting. They will be brought to a close at Turin early in November, and members of the Congress are invited to visit the Exhibition to be held in that city.

Commander Peary's Promotion.—Commander Peary's many admirers will learn with satisfaction of his well-deserved promotion to the rank of Rear-Admiral, only made after the fullest examination of the grounds on which his claims to recognition are based.

OBITUARY.

Baron von Schleinitz.

Vice-Admiral Baron von Schleinitz, who died at the end of last year, was known to geographers principally as commander of the scientific expedition of 1874–76, in the *Gazelle*, sent out by the German Naval Department to observe the transit of Venus, which took place in December of the former year. An obituary notice in the first number of the *Annalen der Hydrographie* for 1911 gives an appreciation of his services in the field of geography and hydrography. An excellent seaman, and also deeply interested in the various branches of scientific investigation entrusted to the members of his staff, Von Schleinitz was eminently qualified to be at the head of such an undertaking, and though his keenness in the execution of his task sometimes led him to run risks that another might have shunned, his promptitude and judgment in emergencies always carried him through. Besides soundings and oceanographical researches of all kinds, the work of the expedition included magnetic, pendulum, and tidal observations, and collections were brought back in the fields of ethnography, zoology, botany, geology, etc. After the conclusion of the voyage, he was appointed chief of the Hydrographical Office with a view to the working out and publication of the voluminous material brought back—a task which, however, it fell to another to carry through. Von Schleinitz presided over the Berlin Geographical Society for a time, and also took an active part in the work of the German Polar Commission in connection with the international polar research in 1882–83; while as first Governor of German New Guinea he had occasion to add to our knowledge of the geography of that region, particularly by his survey of the northern coast of New Pomerania, which disclosed the fact that the supposed outlying group of volcanic islands really formed a peninsula projecting north beyond the general line of the coast (cf. *Journal*, vol. 12, p. 81).

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1910-1911.

Seventh Meeting, February 13, 1911.—Major LEONARD DARWIN, President, in the Chair.

ELECTIONS.—*Leonard Barnes; John Eric Colenso* (*7th Gurkha Rifles*); *Lieut. Arthur Edward W. Cripps, R.N.R.; Sir John Jackson, C.V.O.; Captain E. G. D. Lardner* (*The King's Regt.*); *Robert Smith Mushet; John Murgatroyd; Henry Munt; Reuben Prestige; James Maxwell Grant Prophit; Arthur L. Ridger; Charles Leslie Scholz; George Hall Scott; A. D. Sloane, 2nd Dragoon Guards* (*Queen's Bays*); *Lieut.-Colonel Sir J. R. Dunlop Smith, K.C.S.I., C.I.E.; Thomas Edward Topham; B. T. Watts.*

The paper read was:—

"Further Explorations in Bolivia." By Major P. H. Fawcett, R.A.

RESEARCH DEPARTMENT.

February 16, 1911.—Major LEONARD DARWIN, President, in the Chair.

"Some Antarctic Problems." By Prof. Edgeworth David, F.R.S.

Eighth Meeting, February 27, 1911.—Major LEONARD DARWIN, President, in the Chair.

ELECTIONS.—*Frederick William Bewsher, B.A.; William Roosegaarde Bisschop; T. T. F. Blydenstein; Julian Frederick Gray* (*1st K.G.O. Sappers and Miners*); *Arthur Harold Harries; Thomas Heap Hartley; Wilfred James Hemp; Benjamin R. Hoffman; Frederick Arthur McKenzie; Arthur E. Reed; William Thomas Simmonds; Henry Makinson Spink; Douglas S. Stewart; T. W. Tamplin; Edmund Oswald Thiele; William Thompson; R. F. Wardle.*

The paper read was:—

"Labrador." By Dr. Wilfred T. Grenfell, C.M.G.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are as a rule written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Adriatic—Tide. *M. k.k. Militärg. I.* **29**, 1909 (1910): 93–219. **Gregor.**
Abschluss der temporären Flutmesserbeobachtungen im Adriatischen Meere. Von Julius Gregor. *Chart.*

Alps—Morphology. *Petermanns M.* **57** (1911): [i.] 9–12. **Lautensach.**
Ueber Alpine Randseen und Erosionsterrassen. Bemerkungen zu Dr. E. Gogartens gleichnamiger Arbeit. *Section.*
The work referred to has appeared as a supplementary number (165) of the *Mitteilungen.*

Alps—Morphology. *Petermanns M.* **56** (1910) 2 Halbbd.: 294–296. **Maull.**
Der Grenzgürtel der nördlichen Kalkalpen. Von Otto Maull. *Map.*

Austria—Alps. *Petermanns M., Ergänzungsheft* **168** (1910): pp. 102. **Marek.**
Waldgrenzstudien in den österreichischen Alpen. Von Dr. Richard Marek. *Map.*

Austria—Bohemia. *M. k.k. G. Ges. Wien* **53** (1910): 618–652. **Schneider.**
Materialien zur Landeskunde von Böhmen. Von Dr. Karl Schneider.

Austria—River-ice. *M. k.k. G. Ges. Wien* **53** (1910): 508–579. **Reymann.**
Die Eisverhältnisse der Mur und Drau. Eine Kritisch-methodische Untersuchung von Dr. Franz Reymann.

Austria—Tirol. **Machaček.**
M. k.k. G. Ges. Wien **52** (1909): 659–683; **53** (1910): 490–508.
Tal- und Glazialstudien im unteren Eisackgebiete. Von Dr. Fritz Machaček. *Sections.*

Austria—Tirol—Wind. *Meteorol. Z.* (1910): 481–488. **Heuer.**
Ueber die Ursachen des Malojawindes. Von Dr. W. Heuer. *Diagrams.*
This wind is the valley-wind of the Upper Engadine.

Eastern Europe. **Kreuzbruck v. Lilienfels.**
Petermanns M. **56** (1910) 2 Halbbd.: 281–286, 327–330.
Der türkisch-griechische Kriegsschauplatz. Eine Militärgeographische Studie von Major O. Kreuzbruck v. Lilienfels. *Map.*

Europe—Anthropology. **Baring-Gould.**
Cliff castles and cave dwellings of Europe. By S. Baring-Gould. London: Seeley & Co., 1911. Size 9 × 6, pp. 324. *Plans and Illustrations. Price* 12*s.* 6*d. net. Presented by the Publishers.*

France—Corsica. *Abh. k.k. G. Ges. Wien* **9** (1910): pp. 144. **Lucerna.**
Die Eiszeit auf Korsika und das Verhalten der Exogenen Naturkräfte seit dem Ende der Diluvial Zeit . . . von Dr. Roman Lucerna. *Sketch-maps, Sections, and Illustrations.*

France—Hérault. *B.S. Languedoc. G.* **33** (1910): 1–40. **Sahuc.**
Dictionnaire topographique et historique de l'arrondissement de Saint-Pons, comprenant les noms de lieux anciens et modernes. Par J. Sahuc. Introduction: Mémoire sur l'état des routes et chemins . . . en 1909 et aux époques précédentes.

France—Hérault. *B.S. Languedoc. G.* **32** (1909): 359–384. **Viala.**
Richesse minière de l'Hérault. Par L. Fernand Viala.

France—Olive. *La G., B.S.G. Paris* **22** (1910): 225–240, 301–324. **Blanchard.**
La limite septentional de l'olivier dans les Alpes françaises. *Map and Illustrations.*
See February number, p. 209.

France—Paris. *Petermanns M.* **56** (1910): [i.] 139–140. **Camena d'Almeida.**
Die Pariser Ueberschwemmung im Januar 1910. Von Prof. P. Camena d'Almeida. *Map.*

France—Rivers. *Ann. G.* **19** (1910): 318–342. **Margerie.**
L'Étude du Profil en long des cours l'eau français. Par Emm. de Margerie. *Map.*
See note in the January number, p. 93.

France—Seine. *Ann. G.* **19** (1910): 343–349. **Urry.**
La crue de Janvier 1677 à Paris. Contribution à l'histoire du régime de la Seine. [Par Alfred Urry.]

France—Water-power. **Wohlrabe.**
Deutsche G. Blätter, G. Ges. Bremen **33** (1910): 155–182.
Die Wasserkräfte Frankreichs. Von Willy Wohlrabe.

France—West Coast. *B.S.G. Com. Bordeaux* **33** (1910): 169–172, 206–220. **Lalanne.**
Constitution Géologique du Littoral Océanique du Bas-Médoc dans ses rapports avec la présence de l'Homme préhistorique. Par Dr. G. Lalanne. *Sections.*

France and Switzerland—Rivers. *C.R. IX^e Congrès Int. G.* **2** (1910): 306–822. **Schardt.**
Dérivations glaciaires de cours d'eau dans la Suisse occidentale et le Jura français. Par le Professeur H. Schardt. *Sections.*

Germany—Bavaria. *M.G. Ges. München* **5** (1910): 324–346. **Knauer.**
Die tektonischen Störungslinien des Kesselbergs. Von Dr. Joseph Knauer. *Map, Illustrations, and Diagrams.*

Germany—Bavaria—Lakes. **Herpich.**
Münchener G. Studien (*Günther*) **26** (1911): pp. 90.
Die Eisverhaltnisse in den sudbayerischen Seen. Von Dr. Hans Herpich. *Maps and Diagrams.*

Germany—Bremen. **Rauers.**
Deutsche G. Blätter, G. Ges. Bremen **30** (1907): 78–131; **31** (1908): 37–92. 194–245; **33** (1910): 24–144.
Der bremische Binnenverkehr in der Zeit des grossen Frachtfuhrwerks. Von Friedrich Rauers. *Map.*

Germany—Cartography. *Z. Ges. G. Berlin*, 1910: 607–621. **Penck.**
Zur Vollendung der Karte des Deutschen Reiches 1: 100,000. Von Albrecht Penck.

Germany—Cartography. *Z. Ges. E. Berlin*, 1910: 551–607. **Zglinicki.**
Die Karte des Deutschen Reiches 1: 100,000. Erläutert durch v. Zglinicki. *Maps.*

Germany—Commerce. **Martiny.**
Forschungen deuts. Landes- u. Volksk. (*Hahn*) **19** (1911): 185–349.
Kulturgeographische Wanderungen im Koblenzer Verkehrsgebiet. Von Dr. R. Martiny. *Map and Plans.*

Germany—Hanover. *Globus* **98** (1910): 277–282. **Olbricht.**
Das Diluvium in der Umgebung von Hannover. Von K. Olbricht. *Sketch-maps and Section.*

Germany—Hessen—Survey. **Grossh. Hessisches Kasteramt.**
Notizbl. V. E. Darmstadt, IV. Ser., **30** (1909): 133–169.
Das Grossherzoglich Hessische Hauptnivellement. Bearbeitet und herausgegeben vom Grossh. Hessischem Kasteramt zu Darmstadt.

Germany—Magnetism. *Abh. K. Preuss. Met. I.* **3** (1910): pp. 62. **Nippoldt.**
Magnetische Karten von Südwestdeutschland für 1909 nach eigenen, im Anschluss an die preussische magnetische Landesaufnahme ausgeführten Messungen. Von A. Nippoldt. *Sketch-maps and Illustrations.*

Germany—Mecklenburg—Coast. **Geinitz.**
Das Uferprofil des Fischlandes. Von Dr. E. Geinitz. (Mitteilungen aus der Grossherzogl. Mecklenburg. Geologischen Landesanstalt, 21.) Rostock, 1910. Size 11½ × 9, pp. 12. *Map and Illustrations.*

Germany—Memel. *Deutsche Rundschau G.* **32** (1910): 337–343. **Zweck.**
Ein Bild aus dem Memeldelta. Von Prof. Dr. Alb. Zweck.

Germany—Palatinate. **Häberle.**
Der Pfälzerwald. Entstehung seines Namens, seine geographische Abgrenzung und die Geologie seines Gebietes. Von Dr. Daniel Häberle. (Sonder-Abdruck aus dem Wanderbüchlein des Pfälzerwald-Vereins, 1911.) Kaiserslautern: E.

Grusius, 1911. Size 8 × 5½, pp. 34. *Map, Sections, and Illustrations. Price* 1*m. Presented by the Publisher.*

Germany—Place-names. **Curschmann.**
Forschungen deuts. Landes- u. Volksk. (*Hahn*) **19** (1910): 91–184.
Die deutschen Ortsnamen im Norddeutschen Kolonialgebiet. Von Prof. Dr. F. Curschmann.

Germany—River-navigation. *Petermanns M.* **56** (1910): [i.] 123–126. **Gravelius.**
Zur Frage der Schiffahrtsabgaben auf Deutschen Flüssen. Von Prof. Dr. H. Gravelius. *Map.*

Germany—Pomerania. *Scot. G. Mag.* **26** (1910): 624–633. **Wedderburn.**
A lake survey expedition in Germany: Temperature Observations in the Madüsee.
The expedition was made in company with Dr. Halbfass (see March number, p. 313).

Germany—Towns. *Petermanns M.* **57** (1911): [i.] 4–8. **Olbricht.**
Die Städte des rheinisch-westfälischen Industriebezirk. Von Dr. Konrad Olbricht. *Map.*

Germany—Württemberg. *Petermanns M.* **56** (1910): [i.] 183–186, 246–249. **Gradmann.**
Die ländlichen Siedlungsformen Württembergs. Von Dr. Robert Gradmann. *Maps.*

Hungary—Transylvania. *G.Z.* **16** (1910): 417–427. **Wachner.**
Das Siebenbürgische Erzgebirge. Von Heinrich Wachner. *Sketch-map and Illustrations.*

Iceland—Archæology. *G. Ts., k. Danske G.S.* **20** (1910): 302–315. **Bruun and Jónsson.**
Kaptajn Daniel Bruuns og Prof. Finnur Jónssons Undersøgelser og Udgravninger paa Island 1907–1909. *Plans and Illustrations.*

Italy—Apennines. *Z.G.* **16** (1910): 207–216. **Nussbaum.**
Geomorphologische Studien im nördlichen Apennin zwischen Ancona und Florenz. Von Fritz Nussbaum. *Sketch-map and Illustrations.*

Italy—Apennines. *Z. Ges. E. Berlin* (1910): 491–503. **Rühl.**
Studien in den Kalkmassiven des Apennin. Von Dr. Alfred Rühl.

Italy—Stromboli. *C.R. IX^e Congrès Int. G.* **2** (1910): 235–245. **Platania.**
Stromboli. Dal Dott. Gaetano Platania. *Illustrations.*

Lapland. *Le Globe, S.G. Genève* **49** (1910): Mém. 70–99. **Pictet and Fatio.**
Voyage d'un genevois en Laponie en 1769. Extraits du journal de Jean-Louis Pictet. Par Guillaume Fatio. *Illustrations.*
Pictet accompanied Mallet on the expedition sent by the Russian Government for the observation of the transit of Venus.

Rhine valley. *Z. Ges. E. Berlin* (1910): 77–92, 159–173. **Mordziol.**
Ein Beweis für die Antezedenz des Rheindurchbruchtals nebst Beiträgen zur Entwicklungsgeschichte des Rheinischen Schiefergebirges. Von Dr. C. Mordziol. *Sketch-map, Illustrations, and Sections.*

Russia—Finland. *C.R. IX^e Congrès Int. G.* **2** (1910): 125–133. **Sederholm.**
Sur la géomorphologie de la Finlande. Par le Dr. J. J. Sederholm.

Russian Empire—Soils. *C.R. I^re Conf. Int. Agrogéol.* (1909): 95–113. **Glinka.**
Die Bodenzonen und Bodentypen des europäischen und asiatischen Russlands. Von Prof. K. Glinka. *Map.*

Russian Empire—Temperature. *Met. Z.* **27** (1910): 385–400. **Ficker.**
Temperaturschwankungen in Russland und Nordasien. Von Dr. H. v. Ficker.

Sweden—Earthquakes. *G.Z.* **16** (1910): 490–496. **Kjellén.**
Die Schwedischen Erdbeben. Versuch einer Seismischen Landeskunde. Von Rudolf Kjellén. *Map.*

Sweden—Fish. **Smedberg.**
Teknisk utredning om vattenbyggnader och industriella anläggningar samt dessas inverkan å fisket inom Viskans område. Af Richard Smedberg. (Separat ur Kungl. Landtbruksstyrelsens Meddelanden N. R. 156.) Stockholm, 1910. Size 9½ × 6¼, pp. 46. *Map, Plan, and Illustrations. Presented by the Author.*
On the effect of industrial operations on fish in rivers.

Switzerland—Anthropogeography. **Flückiger.**

Zur Geographie des Menschen auf dem Boden der Schweiz. Von Dr. O. Flückiger. Zürich, 1910. Size 9 × 6, pp. 42.

Switzerland—Anthropogeography. **Wettstein.**

Jb. G.-Ethnogr. Ges. Zürich, 1909–10 (1910): 1–112.

Anthropogeographie des Safientales. Von Otto Wettstein. *Illustrations.*

Switzerland—Bern. *Jb. G. Ges. Bern* **21**, 1906–7 (1909): 63–151. **Bieri.**

Volksdichte und Besiedlung des bernischen Mittellandes. Von Dr. Oscar Bieri. *Maps.*

Switzerland—Grisons. *Petermanns M.* **56** (1910) 2 Halbbd.: 234–235. **Tarnuzzer.**

Nollakorrektion und Lüschersee. Ein Beispiel der Wildbachverbauung in Graubünden. Von Prof. Dr. Chr. Tarnuzzer. *Map.*

On works for the control of the torrents and underground percolation of the upper basin of the Nolla.

Switzerland—National Park. *Globus* **98** (1910): 282–284. **Schröter.**

Der erste Schweizerische "National park." Von Prof. C. Schröter. *Illustrations.*

Turkey—Cartography. *Z. Ges. E. Berlin*, 1910: 430–447. **Von Diest.**

Die Kartographie in der Türkei. Von Oberst a. D. v. Diest.

A review of the available material, both Turkish and foreign.

United Kingdom—Ireland—Rainfall. *Sc. P.R. Dublin S.* **12** (1910): 354–373. **Lyons.**

On the Distribution of Mean Annual Rainfall and average number of rain-days per year over an area including the counties of Dublin, Wicklow, Kildare, and Meath: A study in local variations of Rainfall. By William J. Lyons. *Maps and Diagrams.*

United Kingdom—Scotland—Flora. **Elliot.**

Presidential Address. The Scottish Flora. By Professor Scott-Elliot. (From the *Transactions and Journal of Proceedings of the Dumfriesshire and Galloway Natural History and Antiquarian Society*, Session 1908–09, vol. **21**, 1910.) Dumfries, 1910. Size 8 × 5½, pp. 9–16.

United Kingdom—Scotland—Mull. *Geol. Mag.* V. **7** (1910): 353–355. **Bosworth.**

Wind Erosion on the Coast of Mull. By T. O. Bosworth. *Illustrations.*

ASIA.

Asia Minor. *National G. Mag.* **21** (1910): 761–775. **Huntington.**

The Fringe of Verdure around Asia Minor. By Ellsworth Huntington. *Illustrations.*

The author emphasizes the contrast between the outer fringe and the interior of Asia Minor.

Central Asia. **Etherton.**

Across the Roof of the World: a record of sport and travel through Kashmir, Gilgit, Hunza, the Pamirs, Chinese Turkestan, Mongolia and Siberia. By Lieut. P. T. Etherton. London: Constable & Co., 1911. Size 9½ × 6½, pp. xiv. and 428. *Map and Illustrations. Price* 16*s. net. Presented by the Publishers.*

Central Asia. *J.R. United Service I.* **54** (1910): 1555–1579. **Etherton.**

Through the Heart of Asia. By Lieut. P. T. Etherton. *Illustrations.*

The journey led from India across the Pamirs, Chinese Turkestan, the Tian Shan and Altai ranges to Siberia.

Central Asia. **Obrucheff.**

V. A. Obrucheff. Geographical investigations in Barlik, Maila, and Jair during 1909. Tomsk, 1910. Size 10½ × 6½, pp. 10. [In Russian.]

See note in vol. **35**, p. 722.

Central Asia—Historical. *Petermanns M.* **17** (1911) [i.]: 12–15. **Herrmann.**

Zur alten Geographie Zentralasiens. Von Dr. Albert Herrmann. *Map.*

Central Asia—Lake Aral. **Berg.**

B. Turkestan Br. Imp. Russian G.S. **5** (1908): pp. xxiv. and 580.

Scientific results of the Lake Aral Expedition of the Turkestan Branch, Imperial Russian Geographical Society. Part IX: Lake Aral; a physical-geographical

monograph. By L. Berg. *Maps (facsimile, etc.), Illustrations, and Diagrams.* [In Russian.]

China. **Zikawei Obervatory, Shanghai.**

Observatoire de Zi-ka-wei, Calendrier-annuaire pour 1911 (3e Année de Siuen-T'ong). Shanghai: Imprimerie de la Mission Catholique, 1910. Size 6 × 4, pp. 172 and 68. *Sketch-maps and Diagrams.*

Gives not only reports on the Observatory's own work, but also scientific and general information on the whole of China. The maps show the railways to date.

China—Sechuan and Yunnan. *La G., B.S.G. Paris* **22** (1910): 369–375. **Polignac.**

Explorations dans l'Ouest chinois. Boucle sud du Yang-tseu. Cours inférieure du Ya-long. Par le comte Charles de Polignac. *Sketch-map.*

Some account of this journey was given in the December number, 1910 (p. 731), and that for February, 1911 (p. 211).

China—Western. *M. Seminars Oriental. Sprachen* **13** (1910): 18–48. **Weiss.**

Von Tengyüe über Talifu und Yünnanfu zum Yangtse. Von F. Weiss. *Map and Illustrations.*

China—Yunnan—Tin. **Collins.**

Tin-Production in the Province of Yunnan, China. By W. F. Collins. [A Paper discussed at a meeting of the Institution of Mining and Metallurgy, at the rooms of the Geological Society, Burlington House, Piccadilly, W., on Thursday, December 16, 1909, at eight o'clock p.m.] [London, 1910.] Size 8½ × 5½, pp. 14. *Plan, Sections, and Diagrams.*

Chinese Empire—Tibet. *T'oung Pao* **11** (1910): 1–104. **Rockhill.**

The Dalai Lamas of Lhasa and their relations with the Manchu Emperors of China, 1644–1908. By W. W. Rockhill. *Also separate copy presented by the Author.*

India. **Fraser.**

Among Indian rajahs and ryots: a Civil Servant's recollections and impressions of thirty-seven years of work and sport in the Central Provinces and Bengal. By Sir Andrew H. L. Fraser. London: Seeley & Co., 1911. Size 9 × 6, pp. xvi. and 368. *Map and Illustrations. Price 18s. net. Presented by the Publishers.*

India—Himalayas. *La G., B.S.G. Paris* **22** (1910): 241–246. **Calciati.**

Les fronts des glaciers de Yengutsa et d'Hispar. Par — Calciati. *Map and Illustrations.*

India—Nepal. *Records Botanical Surv. India* **4** (1910): 59–140. **Burkill.**

Notes from a journey to Nepal. By I. H. Burkill. *Map.*

Japan—Asama-yama. *J. Tōkyō G.S.* **22** (1910): 169–223. **Omori and Satō.**

The Eruption of Asama-yama in December, 1909. By F. Omori and D. Satō. *Map.* [In Japanese.]

Japan—Earthquake. *J. Tōkyō G.S.* **22** (1910): 18–36. **Nakamura.**

Preliminary Note on the Omi-Mino Earthquake of August 14, 1909. By S. Nakamura. *Maps.* [In Japanese.]

Japan—Historical. **Gezelius.**

Japan i västerländsk framställning till omkring år 1700: ett geografiskt-kartografiskt försök. Af Birger Gezelius. Linköping 1910. Size 9 × 6, pp. 186.

Japan—Iron. *J. Tōkyō G.S.* **22** (1910): 263–276, 338–347. **Inouye.**

Iron Ore supply in Japan. By. K. Inouye. [In Japanese.]

Japan—Snow-fall. *J. Tōkyō G.S.* **22** (1910): 239–248. **Yazu.**

Snow-fall in Japan. By M. Yazu. [In Japanese.]

Malay Archipelago. *Petermanns M.* **56** (1910): [i.] 306–308. **Elbert and Hagen.**

Bericht über die von Dr. Elbert geführten Sunda-Expedition des Frankfurter Vereins für Geographie und Statistik. Erstattet von Dr. Bernh. Hagen. *Map and Illustrations.*

Malay Archipelago—Natuna islands. **Cornand.**
Deutsche Rundschau G. **32** (1910): 289–301, 362–367, 411–415.

Die Natunainseln. Von Kapitänleutnant D. R. Cornand. *Sketch-maps and Illustrations.*

Pamirs. *Petermanns M.* **56** (1910): [i.] 250–254. **Schultz.**

Volks- und wirtschaftliche Studien im Pamir. Von Arved v. Schultz. *Illustrations.*

Philippine Islands. **Smith and Iddings.**

Handbuch der Regionalen Geolog. (*Steinmann & Wilckens*) **6** (1910) Heft 3, pp. 24. The Philippine Islands. By Warren D. Smith. With a chapter on the Lithology by J. P. Iddings. *Maps and Sections.*

Russia—Siberia. *B.A. Imp. Sc. St. Pétersbourg* (1910): 989–998. **Tolmacheff.**

Nouvelles données sur la géographie de la Sibérie du Nord. Par I. P. Tolmačev. *Sketch-map and Diagram.* [In Russian.]

Sketches the progress of exploration in the region of the lower Khatanga and Anabar, and the results of the writer's own expedition of 1905 (*Journal*, vol. **31**, p. 564).

Russia—Siberia—Baikal. *Petermanns M.* **56** (1910): [i.] 304–305. **Voeikof.**

Der Baikalsee. Von Prof. Dr. Alex. Woeikow. *Map.*

Turkey. **Bell.**

Amurath to Amurath. By Gertrude Lowthian Bell. London: W. Heinemann, 1911. Size 9 × 6, pp. xviii. and 370. *Map and Illustrations. Price* 16*s. net. Presented by the Publishers.*

Reviewed in the present number.

Turkey—Asia Minor. *Petermanns M.* **56** (1910) 2 Halbbd.: 177–181, 236–240. **Endriss.**

Quer durch die Bithynische Halbinsel. Von Dr. Wilhelm Endriss. *Map and Illustrations.*

Turkey—Asia Minor. *Z. Ges. E. Berlin* (1910): 322–330. **Partsch.**

Richard Kieperts Karte von Kleinasien in 24 Blatt 1:400,000. Von J. Partsch. *Maps.*

Turkey—Palestine. *G.Z.* **16** (1910): 177–186. **Hartmann.**

Zur Siedlungskunde des westjordanischen Gebirgslandes. Von Richard Hartmann. *Illustrations.*

Turkey—Palestine—Bibliography. **Thomsen.**

Die Palästina-Literatur; eine internationale Bibliographie in systematischer Ordnung mit Autoren- und Sachregister . . . bearbeitet und herausgegeben von Peter Thomsen, II. Band: Die Literatur der Jahre 1905–09. Leipzig: J. C. Hinrich, 1911. Size 9½ × 6½, pp. xx. and 316. *Price* 8*m.*

Turkey—Syria. *M.V.E. Leipzig*, 1909 (1910): 35–50. **Guthe.**

Die Aufnahme des Ostjordanlandes durch den Deutschen Palästina-Verein. Von Prof. Dr. [H.] Guthe.

Western Asia—Armenia. *Petermanns M.* **56** (1910): [i.] 8–14, 69–74, 126–132. **Oswald.**

Zur tektonischen Entwicklungsgeschichte des Armenischen Hochlandes. Von Dr. Felix Oswald. *Map and Panoramas.*

AFRICA.

Africa—Language. **Madan.**

Living Speech in Central and South Africa. An essay introductory to the Bantu family of languages. By A. C. Madan. Oxford: Clarendon Press, 1911. Size 9½ × 6, pp. 96. *Price* 6*s. net. Presented by the Publishers.*

Algeria—Phytogeography. *Rev. G. Annuelle* **3** (1909): 1–154. **Lapie.**

Etude phytogéographique de la Kabylie du Djurjura. Par G. Lapie. *Maps and Illustrations.*

A thorough piece of work. Besides sketch-maps there are two detailed maps on the scale of 1:200,000.

Belgian Congo—Railway. *Mouvement G.* **27** (1910): 619–627. **Wauters.**

Une ligne directe et nationale à travers le Congo Belge de Matadi au lac Moero. Le Chemin de fer de l'Urua. *Maps.*

Noticed in the Monthly Record, March, p. 318.

East Africa—Boundary Expedition. **Schlobach.**

M. Deutsch. Schutzgebieten **23** (1910): 49–54.

Allgemeiner Bericht über den Verlauf der deutsch-portugiesischen Grenzexpedition zwischen dem Knie des Rowuma-Flusses und dem Ostufer des Njassa. Von Hauptmann Schlobach. *Map.*

The surveys are discussed from a technical point of view in a second article.

Egypt—Desert. *Cairo Sc. J.* **4** (1910): 268–278. **Hurst.**
A journey in the western desert of Egypt. By H. E. Hurst. *Illustrations.*
Noticed in the February number, p. 212.

Egypt—Gulf of Suez. *Geol. Mag.* V. **8** (1911): 1–10. **Ball.**
The Gulf of Suez. By John Ball. *Map and Sections.*
Brings forward further facts in support of the view (*Journal*, vol. **35**, p. 596); that the Gulf of Suez, as well as the Nile valley, owes its origin to erosion (see *ante*, p. 212).

Egypt—Nubia—Archæology. **Schäfer and Junker.**
Sitzb. K. Preuss. A. W. (1910): 579–590.
Bericht über die von der Königlichen Akademie der Wissenschaften in den Wintern 1908–09 und 1909–10 nach Nubien entsendete Expedition. Von H. Schäfer und H. Junker.

French West Africa. **Dubois.**
Félix Dubois. Notre beau Niger. Paris: E. Flammarion, 1911. Size 8 × 5, pp. 302. *Sketch-maps and Illustrations. Price 5 fr. Presented by the Author.*

German South-West Africa—Pans. **Michaelsen.**
M. Deuts. Schutzgebieten **23** (1910): 111–134.
Die Kalkpfannen des östlichen Damaralandes. Von Dr. Heinrich Michaelsen. *Illustrations and Diagrams.*
Noticed in the Monthly Record, *ante*, p. 318.

German South-West Africa—Pans. *Globus* **98** (1910): 378–382. **Michaelsen.**
Die Kalkpfannen des östlichen Damaralandes. Eine Erwiderung von Dr. H. Michaelsen. *Diagrams. Also separate copy, presented by the Author.*
A reply to criticism, by Dr. Passarge (see next entry), of the above paper.

German South-West Africa—Pans. *Globus* **98** (1910): 216–222. **Passarge.**
Die Kalkpfannen des östlichen Damaralandes. Eine kritische Studie. Von S. Passarge. *Sections.*
Criticism of Herr Michaelsen's memoir (cf. *ante*, p. 318). The latter has since replied (see previous entry).

Italian Somaliland. **Ferrari.**
B.S.G. Italiana IV. **11** (1910): 1079–1111, 1230–1237, 1310–1328.
Il Basso Giuba italiano e le concessioni agricole nella Goscia. Monographia del capitano G. Ferrari. *Illustrations.*

Ivory Coast. *La G., B.S.G. Paris* **21** (1910): 72–81. **Gros.**
Mission géodésique et forestière de la Côte d'Ivoire. Par le capitaine Gros. *Sketch-map.*

Kamerun. *Z. Ges. E. Berlin* (1910): 448–465. **Passarge.**
Geomorphologische Probleme aus Kamerun. Von Prof. Dr. S. Passarge. *Sketch-maps and Section.*

Madagascar—Phytogeography. **Hochreutiner.**
C.R. IX^e Congrès Int. G. **2** (1910): 537–547.
Remarques sur la géographie botanique de Madagascar. Par Dr. B. P. G. Hochreutiner.

Morocco. *Rev. G. Annuelle* **3** (1909): 471–495. **Gentil.**
Une Leçon de geógraphie physique sur le Maroc. Par Louis Gentil. *Sketch-maps and Illustrations.*
Gives an excellent general idea of the physical features of Morocco.

Morocco. **Mackenzie.**
The Khalifate of the West; being a general description of Morocco. By Donald Mackenzie. London: Simpkin, Marshall & Co., 1911. Size 9 × 5½, pp. xiv. and 274. *Sketch-maps and Illustrations. Price 10s. 6d. Presented by the Publishers.*

Nigeria—Northern—Kwolla. *J. African S.* **10** (1910): 16–52, 213–221. **Fitzpatrick.**
Some notes on the Kwolla District and its Tribes. By J. F. J. Fitzpatrick. *Sections and Diagrams.*
The second paper includes linguistic data.

Ruwenzori. *Jb. Schweizer Alpenclub* **45** (1909–10 (1810)): 153–181. **David.**
Mondgebirge (Runssoro, Ruwenzori). Von Dr. J. David. *Sketch-map, Portrait, and Illustrations.*

Extracts from the journal of this deceased traveller (cf. *Journal*, vol. **24**, p. 348; **25**, p. 93).

South Africa—Archæology. **Johnson.**
The pre-historic period in South Africa. By J. P. Johnson. London: Longmans & Co., 1910. Size 10 × 7, pp. vi. and 90. *Plans, Illustrations, and Section. Price* 10*s. Presented by the Publishers.*

South Africa—Bushmen. *M. Deuts. Schutzgebieten* **23** (1910): 135–160. **Kaufmann.**
Die Auin. Ein Beitrag zur Buschmannforschung. Von Hans Kaufmann. *Sketch-map and Illustrations.*

Illustrated by a large number of photographs of the people and by drawings of their weapons, etc.

Togo—Frontier. *Deutsches Kolonialblatt* **21** (1910): 889–894. **Seefried.**
Die Festlegung der Nord- und Ostgrenze von Togo. Aus einem Vortrag des Hauptm. Freiherrn v. Seefried. *Illustrations.*

On the work of the Boundary Commission in 1908–9.

Tunis. *Rev. G. Annuelle* **3** (1909): 393–470. **Pervinquière.**
Le Sud Tunisien. Par L. Pervinquière. *Sketch-map, Diagrams, and Illustrations.*

A very complete study of Southern Tunis from all points of view.

West Africa—Boundary Survey. **Ambronn.**
M. Deutschen Schutzgebieten **23** (1910): 171–189.
Bericht über die astronomisch-geodätischen Ergebnisse der deutsch-französischen Expedition zur Aufnahme des Ostkamerun-Grenzgebietes. Nach den Beobachtungen der Herren v. Seefried, Winckler und v. Reitzenstein in den Jahren 1905–1907, bearbeitet und zusammengestellt von L. Ambronn. *Plan.*

NORTH AMERICA.

Alaska—Glaciers. *B. Amer. G.S.* **42** (1910): 721–738. **Grant and Higgins.**
Glaciers of Prince William Sound and the Southern Part of the Kenai Peninsula. I. Glaciers of the Northern Part of Prince William Sound. By U. S. Grant and D. F. Higgins. *Sketch-maps and Illustrations.*

Alaska—Glaciers. *Z. Gletscherkunde* **5** (1910): 1–35. **Tarr.**
The Theory of Advance of Glaciers in Response to Earthquake shaking. By Prof. Ralph S. Tarr. *Sketch-map and Illustrations.*

Cf. note in vol. **35**, p. 221.

America—Railway. *G.Z.* **16** (1910): 537–545. **Hennig.**
Das Unternehmen der panamerikanischen Bahn. Von Richard Hennig.

Canada—Rocky mountains. *B. American G.S.* **42** (1910): 496–511. **Kinney.**
Ascent of Mount Robson, the Highest Peak in the Canadian Rockies. By George Kinney. *Illustrations.*

This, the first, ascent of Mount Robson was made in 1909.

Canada—Selkirks. *Alpine J.* **25** (1910): 215–231. **Palmer.**
Three New Ascents in the Selkirks. By Howard Palmer. *Illustrations.*

Canada—Vancouver island. ———
Vancouver Island, British Columbia, Canada. The treasure island: agriculture, timber, mines, and fisheries. A history of its resources by districts. Compiled by the Vancouver Island Development League. [Victoria, 1910.] Size 10 × 6½, pp. 128. *Illustrations. Presented by the League.*

Canada—Yukon—Glaciers. *J. Geology* **18** (1910): 549–553. **Tyrrell.**
"Rock Glaciers" or Chrystocrenes. By J. B. Tyrrell. *Illustrations.*

Suggested by Mr. Capps' paper in the same journal (*G.J.*, vol. **36**, p. 615). The examples here cited seem, however, to differ somewhat in character from those described by Mr. Capps.

Mexico—Cordoba. *B.S. Mexicana G.* V. Epoca, 3 (1910): 447–460. **Mena.**

El canton de Cordoba: Apuntes de geografia, estadistica e historia. Por José M. Mena.

Mexico—Volcanoes. *National G. Mag.* 21 (1910): 741–760. **Melgareio and Wonson.**

The Greatest Volcanoes of Mexico. With text by Mr. A. Melgareio and Photographs by S. L. Wonson. *Illustrations.*

Niagara Falls. **Spencer.**

Relationship of Niagara River to the Glacial Period. Relative Work of the Two Falls of Niagara. Interruption in the Flow of the Falls of Niagara in February, 1909. By J. W. Spencer. [Reprinted from the *Bulletin of the Geological Society of America*, vol. 21, August 10, 1910.] [New York, 1910.] Size 10¼ × 7, pp. 433–448. *Illustrations. Presented by the Author.*

Niagara Falls. *La G., B.S.G. Paris* 22 (1910): 105–118. **Spencer.**

L'évolution des chutes du Niagara. Par J. Winthrop Spencer. *Sketch-maps.*

United States. **Meakin.**

What America is doing: letters from the New World. By Annette M. B. Meakin. Edinburgh, etc.: W. Blackwood & Sons, 1911. Size 9 × 5¾, pp. xviii. and 364. *Illustration. Price* 10*s.* 6*d. net. Presented by the Publishers.*

United States—Atlas. **Smith.**

United States Geological Survey. The Topographic and Geologic Atlas of the United States. By George Otis Smith, Director. Washington, 1909. Size 9 × 6, pp. 16. *Sections.*

United States—California—Earthquakes. **Rothpletz.**

Sitz. K.A.W. München (1910): Abh. 8, pp. 32.

Ueber die Ursachen des Kalifornischen Erdbebens von 1906. Von A. Rothpletz. *Maps and Diagram.*

United States—California—Name. **Davidson.**

T. and P.G.S. Pacific, Ser. II. 6 (1910): 1–50.

The Origin and the Meaning of the Name California. Calafia the Queen of the Island of California. By George Davidson.

United States—Geology. **Williams and others.**

U.S. Geological Survey. Folio 169.—Field Edition. Geologic Atlas of the United States. Watkins Glen-Catatonk Folio. By H. S. Williams, R. S. Tarr, and E. M. Kindle. Washington, 1909. Size 9½ × 6, pp. 242. *Maps, Sections, Diagrams, and Illustrations.*

United States—Indiana. *J.G.* 9 (1910): 17–22. **Dryer.**

Geographic Influences in the Development of Indiana. By Charles R. Dryer.

United States—Maryland. **Clark and others.**

Maryland Geological Survey. Vols. 7 and 8. Baltimore: Johns Hopkins Press, 1908–1909. Size 10½ × 7, pp. (vol. 7) 412; (vol. 8) 486. *Maps, Plans, Diagrams, and Illustrations.*

Vol. 7 is devoted to a report on the re-survey of the Maryland-Pennsylvania boundary, forming part of the historic Mason and Dixon line (by W. B. Clark and others). Vol. 8 deals with State highway construction, the Maryland mineral industries, etc.

United States—Maryland. **Shreve and others.**

Maryland Weather Service. Vol. 3. The Plant-life of Maryland. By Forest Shreve, M. A. Chrysler, Frederick H. Blodgett, and J. W. Besley. Baltimore: Johns Hopkins Press, 1910. Size 10½ × 7, pp. 534. *Sketch-maps, Diagrams, and Illustrations.*

The whole of this volume is occupied by a detailed discussion of the geography and economics of plant-life in Maryland.

United States—Massachusetts. *B.G.S. Philadelphia* 8 (1910): (172)–(190). **Roorbach.**

Shoreline changes in the Winthrop area, Massachusetts. By George B. Roorbach. *Sketch-map and Illustrations.*

United States—Surveys. *Petermanns M.* 56 (1910): 2 Halbbd. 85–86. **Haack.**

Der gegenwärtige Stand der topographischen Aufnahme der Vereinigten Staaten. Von Dr. Hermann Haack. *Map.*

United States—Waterways. *Deuts. Rundschau G.* **33** (1910): 23–29. **Fehlinger.**
Binnenschiffahrtswege in den Vereinigten Staaten von Amerika. Von Hans Fehlinger. *Map.*

CENTRAL AND SOUTH AMERICA.

Amazon valley—Tribes. **Markham.**
A List of the Tribes of the Valley of the Amazons, including those on the banks of the Main Stream and of all the Tributaries. Attempted by Sir Clements Markham. (Third edition, 1910.) (Reprinted from the *Journal of the Royal Anthropological Institute*, vol. **40**, January–June, 1910.) Size 11 × 7½, pp. 73–140. *Presented by the Author.*

Argentine. ———
La Nacion [Special number of newspaper commemorating the Centenary of the Independence of Argentina.] [Buenos Ayres, 1910.] Size 18½ × 12½, pp. [700]. *Portraits, Sketch-maps, and Illustrations. Presented by the Proprietors.*

Argentine—Hydrology. *Rev. Museo La Plata* **16** (1909): 171–203. **Roth.**
La construcción de un canal de Bahía Blanca á las provincias andinas, bajo el punto de vista hidrogeológico. Por el Dr. Santiago Roth. *Map, Profiles, and Illustrations.*

Bolivia. *Globus* **97** (1910): 213–219. **Nordenskiöld.**
Meine Reise in Bolivia 1908–09. Von Erland Nordenskiöld. *Illustrations.*

Bolivia—Acre. **Sagárnaga.**
Dr. Elias Sagárnaga. Recuerdos de la Campaña del Acre de 1903: mis notas de viaje. La Paz, 1909. Size 8 × 5½, pp. 194.

Bolivia—Ethnology. *Petermanns M.* **57** (1911) [i.]: 16–17. **Nordenskiöld.**
Die Siriono-Indianer in Ostbolivien. Mitteilung von der Hernmarckschen Expedition. Von Erland Frhrn v. Nordenskiöld. *Map and Illustrations.*

Bolivia—Ethnology. *Ymer* **30** (1910): 275–284. **Nordenskiöld.**
Antropogeografiska studier i östra Bolivia. (Meddelande från Hernmarckska-expeditionen 1908–1909. Af Erland Nordenskiöld. *Illustrations.*

Brazil. **Denis.**
Brazil. By Pierre Denis. Translated, and with a historical chapter, by Bernard Miall, and a supplementary chapter by Dawson A. Vindin. (The South American Series.) London: T. Fisher Unwin, 1911. Size 9 × 5½, pp. 388. *Maps and Illustrations. Price* 10*s.* 6*d. net. Presented by the Publisher.*

Brazil—Bahia. *Amer. J.Sc.* IV. Ser. **30** (1910): 335–343. **Branner.**
The Tombador escarpment in the State of Bahia, Brazil. By John C. Branner.

Brazil—Water-storage. **Pires.**
B. Ministerio Viação e Obras Publ., Brazil **3** (1910): 11–100.
Noticia dos estudos e obras contra os effeitos da secca. Por Antonio Olyntho dos Santos Pires. *Maps, Sections, Diagrams, and Illustrations.*

British Guiana. **Harrison and Reid.**
Geol. Mag. Dec. V. 7 (1910): 439–452, 488–495, 553–562.
The residual earths of British Guiana commonly termed "Laterite." By Prof. J. B. Harrison, assisted by K. D. Reid.

Costa Rica. *B.S.G. Com. Paris* **32** (1910): 693–714. **Périgny.**
Costa Rica. Le pays, ses habitants et ses ressources. Par le Comte Maurice de Périgny.

Peru—Marañon. *Z. Ges. E. Berlin* (1910): 511–524. **Sievers.**
Die Quellen des Marañon-Amazonas. Von Prof. Dr. Wilhelm Sievers. *Map.*
See note in the January number, p. 97.

Peru—Ucayali. *Petermanns M.* **56** (1910) 2 Halbbd. 20. **Payer.**
Von Ucayali nach den Bergen von Condamana. Von Dr. Richard Payer. *Map.*

South America. *Petermanns M.* **56** (1910): 2 Halbbd. 250–251. **Wickenburg.**
Uebersicht meiner Reisen in Südamerika 1907–10. Von Eduard Graf von Wickenburg.

The count (previously known as an African explorer) visited all the South American Republics except the three in the north-west. The new Bolivia-Peru frontier appears to be drawn incorrectly in the map.

South America—Legend. *M. k.k. G. Ges. Wien* **53** (1910): 278–289. **Lasch.**
Zur südamerikanischen Amazonensage. Von Dr. Richard Lasch.

AUSTRALASIA AND PACIFIC ISLANDS.

Australia. **Taylor.**
Australia in its physiographic and economic aspects. By Griffith Taylor. (The Oxford Geographies, edited by A. J. Herbertson.) Oxford: Clarendon Press, 1911. Size 7¼ × 5, pp. 256. *Sketch-maps and Diagrams. Price* 3*s.* 6*d. Presented by the Publishers.*

Bismarck Archipelago. **Sapper and Lauterbach.**
M. Deuts. Schutzgebieten, Ergänzungsh. Nr. 3 (1910): pp. 130.
Wissenschaftliche Ergebnisse einer amtlichen Forschungsreise nach dem Bismarck-Archipel im Jahre 1908. I.—Beiträge zur Landeskunde von Neu-Mecklenburg und seinen Nachbarinseln. Von Dr. Karl Sapper. Mit einem Beitrag von Dr. C. Lauterbach. *Maps and Illustrations.*

New South Wales—Morphology. **Hedley.**
Presidential Address. The Submarine Slope of New South Wales. (From the *Proceedings of the Linnean Society of New South Wales*, 1910, vol. **35**, Part I., March 30.) [Sydney], 1910. Size 8½ × 5½, pp. 22. *Section and Illustrations.*

New Zealand—Auckland. **Fraser.**
New Zealand Geol. Surv. B. No. **10** (1910): pp. viii. and 136.
The Geology of the Thames Subdivision, Hauraki, Auckland. By Colin Fraser. *Maps, Sections, Diagrams, and Illustrations.*

New Zealand—Dunes. **Cockayne.**
New Zealand: Department of Lands. Report on the sand-dunes of New Zealand. By Dr. L. Cockayne. Wellington, 1909. Size 18½ × 8½, pp. 30. *Illustrations.*
Noticed in vol. **36**, p. 92.

New Zealand—Glaciation. *T. and P. New Zealand I.* **42** (1909): 248–353. **Thomson.**
Botanical Evidence against the Recent Glaciation of New Zealand. By Geo. M. Thomson.

New Zealand—Ice-age. *T. and P. New Zealand I.* **42** (1909): 589–612. **Park.**
The Great Ice Age of New Zealand. By Prof. James Park. *Illustrations.*

New Zealand—Wellington—Botany. **Aston.**
T. and P. New Zealand I. **42** (1909): 13–25.
Botanical Notes made on a Journey across the Tararuas. By Bernard Cracroft Aston. *Sketch-map and Illustrations.*

Pacific—German colonies. **Thurnwald.**
Das Rechtsleben der Eingeborenen der deutschen Südseeinseln, seine geistigen und wirtschaftlichen Grundlagen. Auf Grund einer im Auftrage des Berliner Museums für Völkerkunde unternommenen Forschungsreise 1906–09. Von Dr. Richard Thurnwald. Berlin, 1910. Size 8 × 5, pp. 46. *Presented by the Author.*

Pacific—German colonies. **Thurnwald.**
Die eingeborenen Arbeitskräfte im Südseeschutzgebiet. Von Dr. R. Thurnwald. (Sonderabdruck aus der *Kolonialen Rundschau*, Berlin, Heft 10, Oktober 1910). Size 9½ × 6½, pp. 607–632. *Illustrations.*

Pacific islands—Geology. *T. and P. New Zealand I.* **42** (1910): 241–254. **Speight.**
Petrological Notes on Rocks from the Kermadec Islands; with some Geological Evidence for the Existence of a Subtropical Continent. By R. Speight.

Samoa—Geology. *Abh. K.A.W. München* **24** (1910): 507–542. **Friedländer.**
Beiträge zur Geologie der Samoainseln. Von Immanuel Friedländer. *Maps and Illustrations.*

Samoa—Volcano. *Quart. J. Geol. S.* **66** (1910): 621–639. **Anderson.**
The volcano of Matavanu in Savaii. By Tempest Anderson. *Sketch-map and Illustrations.*
Illustrated by a striking series of photographs by the author. A short description appears also in *Nature*, vol. **85** (1910): 92–93.

Solomon islands—Bougainville. **Sapper.**
M. Deutschen Schutzgebieten **23** (1910); 206–217.
Eine Durchquerung von Bougainville. Von Karl Sapper. *Map, Section, and Illustrations.*

Solomon islands—Buka. *M. Deutschen Schutzgebieten* **23** (1910): 193–206. **Sapper.**
Buka. Nach Aufnahmen von Hauptmann a. D. Dr. G. Friederici und Bergingenieur Schön sowie eigenen Beobachtungen von Professor Dr. Karl Sapper. *Maps, Section, and Illustrations.*

Tahiti. **Lebeau.**
Henri Lebeau. Otahiti: au pays de l'éternel été. Paris: A. Colin, 1911. Size 7½ × 5, pp. xviii. and 262. *Price* 3.50 *fr.* *Presented by the Publisher.*

Victoria. *Victorian G.J.* **26–27** (1908–9): 1–8. **Kernot.**
The Upper Yarra. By Prof. W. C. Kernot.

Victoria—Essendon. **Armitage.**
Notes on the country about West Essendon. By R. W. Armitage. (Reprinted from the *Victorian Naturalist*, vol. 47, No. 5, 1910.) [Melbourne], 1910. Size 8½ × 5½, pp. 83–98. *Illustrations.* *Presented by the Author.*

Victoria—Murray river. *Victorian G.J.* **26–27** (1908–9): 30–36. **Macdonald.**
The Hume river. By A. C. Macdonald. *Sketch-map.*
Urges that Hume's name should be restored to the upper Murray, first discovered by him.

POLAR REGIONS.

Antarctic—Ice. **Drygalski.**
Sitzb. K. Bayer. A.W. München, Math.-phys. Kl., 1910: No. 9; pp. 44.
Das Schelfeis der Antarktis am Gaussberg. Von Erich von Drygalski. *Sketch-map.* *Also separate copy* (size 8½ × 5½).
A previous discussion of "shelf-ice" was referred to in vol. 35, p. 725.

Antarctic—Ice. *Z. Gletscherkunde* **5** (1910): 36–73. **Hobbs.**
The Ice Masses on and about the Antarctic Continent. By Prof. Wm. Herbert Hobbs. *Maps, Sections, and Illustrations.*

Antarctic—Meteorology. *Quart. J.R. Meteorol. S.* **36** (1910): 361–374. **Mossman.**
The present position of Antarctic Meteorology. By R. C. Mossman. *Sketch-map.*

Antarctic—Tides. *P.R.S.* Ser. A. **84** (1910): 403–422. **Darwin.**
The Tidal Observations of the British Antarctic Expedition, 1907. By Sir George Darwin.
See note in the Monthly Record, February, p. 216.

Greenland. *Ymer* **30** (1910): 17–46. **Nordenskjöld.**
Från danska Sydvästgrönland. Af Otto Nordenskjöld. *Illustrations.*

Greenland—Minerals. **Giesecke.**
Meddelelser om Grønland **35** (1910): pp. xxxviii. and 532.
Karl Ludwig Gieseckes Mineralogisches Reisejournal über Grönland, 1806–13. (2te Ausgabe 1910.) *Portrait and Illustrations.*

MATHEMATICAL GEOGRAPHY.

Aerial Navigation. *Rev. G. Annuelle* **3** (1909): 551–571. **Berget.**
Les applications de l'aéronautique à la géographie. Par Alphonse Berget. *Diagrams and Illustrations.*

Cartography. **Service Géographique (France).**
Service Géographique de l'Armée. Rapport sur les travaux exécutés en 1909. Paris, 1910. Size 10 × 6½, pp. 52. *Index-map.*

Geodesy. *M. k.k. Militärg. I.* **29**, 1909 (1910): 41–69. **Gaksch.**
Trigonometrische Längenbestimmung geodätischer Grundlinien. Bericht über einen praktischen Messversuch von Karl Gaksch.

Position-fixing. *Ann. Hydrographie* **38** (1910): 614–622, 674–686. **Brill.**
Ueber eine neue einheitliche Methode zur nautischen und aeronautischen Ortsbestimmung aus Gestirnsmessungen. Von Dr. Alfred Brill. *Diagram.*
This is referred to elsewhere in the present number.

Reconnaissance. **Mockler-Ferryman.**
Military sketching, map reading, and reconnaissance. By Lieut.-Colonel A. F.

Mockler-Ferrymann. 2nd edit. London: E. Stanford, 1911. Size 7½ × 5, pp. xii. and 202. *Map and Illustrations. Price 5s. net. Presented by the Publisher.*

The first edition of this little book, perhaps the best of its size which has appeared, came out in 1903.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Biogeography. *G.Z.* **16** (1910): 545–560. **Arldt.**

Das arktische Gebiet als Entwicklungszentrum. Von Th. Arldt.

Biogeography—Oceanic Life. **Nathansohn.**

B.I. Océanogr. Monaco, No. 188 (1910): pp. 10.

Quelques remarques sur le programme hydrobiologique de Monaco. Par Alexander Nathansohn.

Climatology. *Cairo Sc. J.* **4** (1910): 280–281. **Ball.**

Climatological diagrams. By John Ball. *Diagrams.*

The diagrams show the combined fluctuations of temperature and relative humidity through the year by means of closed curves, which afford a graphic comparison between different stations as regards those factors.

Climatology. *Quart J.R. Meteorol. S.* **36** (1910): 341–353; *Discussion,* 353–360. **Craig.**

England—Abyssinia—The South Atlantic: A Meteorological Triangle. By J. I. Craig. *Map and Diagrams.*

Discusses the relations of the three localities mentioned in respect of weather (see Monthly Record, February, p. 218).

Meteorology—Rainfall. *C.R. IX^e Congrès Int. G.* **2** (1910): 444–454. **Hellmann.**

Ueber die extremen Schwankungen des Regenfalls. Von Prof. Dr. G. Hellmann.

Oceanography. **Krümmel.**

Handbuch der Ozeanographie. Von Dr. Otto Krümmel. Zweite . . . Auflage, Band II. Die Bewegungsformen des Meeres (Wellen, Gezeiten, Strömungen). (Bibliothek Geographischer Handbücher, begründet von Friedrich Ratzel; Neue Folge, herausgegeben von Prof. Dr. A. Penck.) Stuttgart: J. Engelhorn, 1911. Size 9 × 6½, pp. xvi. and 754. *Sketch-maps and Diagrams. Price* 32*m. Presented by the Publishers.*

Band I., published in 1907, was reviewed in vol. **32**, p. 300. A review of Band II., which completes the work, will be given shortly.

Oceanography—Deposits. *C.R. IX^e Congrès Int. G.* **2** (1910): 426–432. **Philippi.**

Ueber Sandablagerungen am Boden der Küstenfernen Tiefsee. Von Prof. Dr. E. Philippi.

Oceanography—Equipment. *M. k.k. G. Ges. Wien* **53** (1910): 196–216. **Götzinger.**

Die ozeanographische Ausrüstung des österreichischen Forschungsschiffes "Adria." Von Dr. Gustav Götzinger. *Illustrations.*

Oceanography—Map. *B.I. Océanog. Monaco.* No. 175 (1910): pp. 12. **Bourée.**

Carte Générale Bathymétrique des Océans. Rapport destiné aux membres de la Deuxième Commission. Par H. Bourée.

Oceanography—Mediterranean. *Ann. Hydrographie* **37** (1909): 435–447. **Forch.**

Ueber die Beziehungen zwischen Wind und Strom im Europäischen Mittelmeer. Von Dr. Carl Forch. *Chart and Diagram.*

Oceanography—North Sea. **Everdingen.**

Oberflächentemperaturbeobachtungen in der Nordsee. II. September 1904—August 1905. Von Dr. E. von Everdingen. (Koninklijk Nederlandsch Meteorologisch Instituut, No. 102. Mededeelingen en Verhandelingen, No. 10.) Utrecht, 1910. Size 10 × 6½, pp. 12. *Charts.*

Oceanography—Sea-water. **Thoulet and Chevallier.**

B.I. Océanog. Monaco, No. 181 (1910): pp. 8.

Mesure des densités d'eaux marines par flotteurs totalement immergés. Par J. Thoulet et Chevallier. *Diagram.*

Oceanography—Voyage of the Planet. **Brennecke.**

C.R. IX^e Congrès Int. G. **2** (1910): 403–409.

Tiefsee-Forschungen der "Planet"-Expedition (1906–07). Von Dr. W. Brennecke. *Diagrams.*

Petroleum. *Cairo Sc. J.* **4** (1910): 205–218. **Hume.**
Petroleum: its Occurrence and Origin. By Dr. W. F. Hume.
The author concludes that the evidence tends to establish the *animal* origin of petroleum (see note in Monthly Record, February, p. 220).

Ripple-mark. *P.R.S.*, Ser. A. **84** (1910): 285–310. **Ayrton.**
The Origin and Growth of Ripple-mark. By Mrs. Hertha Ayrton. *Diagrams and Illustrations.*

Seismology. *Rev. G. Annuelle* **3** (1909): 593–631. **Vélain.**
Les Tremblements de terre récents. Californie, 1906—Détroit de Messine, 1908—Provence, 1909. Leurs effets et leurs causes. Par Ch. Vélain. *Sketch-maps and Illustrations.*

Seismology—Oceans. *C.R. IX^e Congrès Int. G.* **2** (1910): 220–234. **Gerland.**
Das seismische Verhalten des Atlantischen und des Pacifischen Ozeans.

Soil-formation. *C.R. I^re Conf. Int. Agrogéol.* (1909): 131–161. **Treitz.**
Was ist Verwitterung. Von P. Treitz.
Distinguishes the various zones of soil formation, according to climatic and other factors.

Soils and Climate. *C.R. I^re Conf. Int. Agrogéol.* (1909): 163–176. **Cholnoky.**
Ueber die für Klimazonen bezeichnenden Bodenarten. Von Dr. E. von Cholnoky. *Map.*

Tides. *Beiträge Geophysik* **10** (1909): 156–172. **Fuchs.**
Die Flutbewegungen in verschiedenen Tiefen des Meeres. Von Karl Fuchs. *Diagrams.*

Volcanoes. *C.R. IX^e Congrès Int. G.* **2** (1910): 187–200. **Johnston-Lavis.**
Mécanisme de l'activité volcanique. Par le Prof. H. J. Johnston-Lavis. *Illustrations.*

Volcanoes. *C.R. IX^e Congrès Int. G.* **2** (1910): 250–261. **Ricco.**
Rôle de l'eau dans les phénomènes éruptifs. Par A. Ricco.

Volcanoes. *C.R. IX^e Congrès Int. G.* **2** (1910): 262–285. **Sapper.**
Die geographische Bedeutung der Vulkane. Von Prof. Dr. Karl Sapper.

Zoogeography. **Finn.**
The wild beasts of the world. By Frank Finn. London: T. C. & E. C. Jack, [1910]. Size 11½ × 8, pp. xii. and 404. *Illustrations. Price 7s. 6d. Presented by the Publishers.*

Zoogeography—Bird-migration. *Petermanns M.* **56** (1910): [i.] 241–245. **Eckardt.**
Die Geographischen Grundlagen des Vogelzugproblems. Von Dr. Wilh. R. Eckardt.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Agriculture. *B. American G.S.* **42** (1910): 270–282, 481–495. **Arctowski.**
Studies on Climate and Crops. By Henryk Arctowski. *Sketch-maps and Diagrams.*
The first paper treats of variations in the distribution of pressure in North America; the second with the variation in the yield of wheat in the United States and Russia.

Anthropogeography—Cold-effects. **Lindhard.**
Meddelelser om Grønland **44** (1910): 75–175.
Danmark-Ekspeditionen til Grønlands Nordostkyst 1906–1908. Contribution to the physiology of respiration under the Arctic climate. By J. Lindhard. *Diagrams.*

Anthropogeography—Maps. *B.S.R.G. Madrid* **52** (1910): 328–337. **Blázquez.**
Los mapas demográficos. Por Antonio Blázquez.

Anthropogeography—Towns. *B.S. Neuchatel. G.* **20** (1909–10): 213–231. **Clerget.**
L'urbanisme. Etude historique, géographique et économique. Par Pierre Clerget.

Military Geography. *Petermanns M.* **56** (1910): [i.] 53–55, 117–118. **Porro.**
Aufgaben und Methoden der Militärgeographie. Von Generalmajor Carlo Porro. *Maps.*

Railways. *Petermanns M.* **56** (1910): [i.] 357–358. **Tronnier.**
Ueber Eisenbahnferne und Eisenbahnfernekarten. Von Rich. Tronnier. *Map.*

BIOGRAPHY.

Agassiz. *Popular Sc. Monthly* **77** (1910): 417–446. **Mayer.**

Alexander Agassiz, 1835–1910. By Alfred Goldsborough Mayer. *Portrait.*

Hovgaard. *Ymer* **30** (1910): 301–304. **Nordquist.**

Andreas Peter Hovgaard. Af Oscar Nordquist.

This Danish naval officer is best known for the part which he took in the voyage of the *Vega*.

James. *R. Engineers J.* **12** (1910): 191–206, 271–282, 355–366; 443–452. **Vetch.**

Major-General Edward Renouard James, Royal Engineers. By Colonel Robt. H. Vetch.

General James had an active and varied career, and, besides other survey work, was attached for a time to the Ordnance Survey. He was the owner of the Glareanus manuscript described in the *Journal* for June, 1905.

GENERAL.

Almanack. **Olsen.**

The Fisherman's Nautical Almanack, Tide Tables, and Directory of British and Foreign Fishing Vessels, Sail and Steamers. 1911. By O. T. Olsen. [London:] Imray, Laurie, Norie, & Wilson, Ltd. Size 7½ × 5, pp. xlvi. and 522. *Presented by the Author.*

Bibliography. **Raveneau.**

Annales de Géographie. No. 107, XIX^e^ Année, 15th Septembre 1900. XIX^e^ Bibliographie Géographique Annuelle, 1909. Publiée sous la direction de Louis Raveneau. Paris: Armand Colin, [1910]. Size 10 × 6½, pp. 336.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Austria. **K. Akad. d. Wissenschaften in Wien.**

Historischer Atlas der österreichischen Alpenländer. Herausgegeben von der Kais. Akademie der Wissenschaften in Wien. I. Abteilung: Die Landgerichtskarte, bearbeitet unter Leitung von weil. Eduard Richter. 2. Lieferung. Vienna: Adolf Holzhausen, 1910.

A notice of this historical atlas of the Alpine provinces of Austria appeared in the *Geographical Journal* for June, 1907. This, the second part to be issued, contains twelve sheets, which, as regards topography, are, like the other, based on the 1:200,000 Austrian Staff map, with the boundaries and special information added. The atlas was originally planned by the late Dr. Eduard Richter, and is now being published by the Imperial Academy of Sciences in Vienna. The present part is accompanied by two pamphlets containing full explanatory and descriptive text, one of which deals with Lower Austria, and the other with the Tyrol and Vorarlberg.

Austria. **Rothaug and Trunk.**

Schulwandkarte des Herzogtums Steiermark. Bearbeitet von Joh. Georg Rothaug und Hans Trunk. Scale 1:150,000 or 1 inch to 2·4 stat. miles. 6 sheets. Vienna: G. Freytag & Berndt, [1910]. *Price, in sheets*, 28*K*. *Presented by the Publishers.*

An effective school wall map, showing relief by a combination of orographical colour tinting and shading, similar with others of the same series. When mounted together the map measures 70 inches by 60 inches.

Austria—Vienna. **Freytag.**

G. Freytag's neuester Orientierungsplan von Wien. Scale 1:15,000 or 4·2 inches to 1 stat. mile. Vienna: G. Freytag & Berndt, 1911. *Price* 60 *Heller. Presented by the Publishers.*

Austria—Vienna. **Freytag.**

G. Freytag's Verkehrsplan der K. K. Reichshaupt- und Residenzstadt Wien. Mit Plan und Strassenverzeichnis des XXI. Bezirkes Floridsdorf. Scale 1:15,000 or

4·2 inches to 1 stat. mile. Vienna: E. Freytag & Berndt, 1911. *Price* 1.50 *Kr.* *Presented by the Publishers.*

British Isles—England and Wales. **Ordnance Survey**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from February 1 to 28, 1911.

1-inch scale maps:—

England and Wales. 3rd edition, 164, 245, engraved in Outline. *Price* 1*s. each.* Ditto, 3rd edition, 164, 210, 211, 240, hills black or brown. *Price* 1*s. each.*

6-inch scale maps:—

Cheshire, 9 sheets. **Hampshire,** 21 sheets. **Lancashire,** 3 sheets. **Sussex,** 2 sheets. **Yorkshire,** 8 sheets. *Price* 1*s. each.*

1 : 2500 Scale:—

Cheshire, 9 sheets. **Hampshire,** 27 sheets. **Lancashire,** 6 sheets. **Sussex,** 17 sheets. **Yorkshire,** 17 sheets. *Price* 3*s. each.*

(*E. Stanford, London Agent.*)

British Isles—England. **Railway Clearing House.**

Official Railway Map of the Gloucestershire and Oxfordshire districts. Scale 1:126,720 or 1 inch to 2 stat. miles. Prepared and published at the Railway Clearing House, London, 1911.

British Isles—England. **Stanford.**

A new map of Metropolitan Railways, Tramways, and Miscellaneous Improvements deposited at the London County Council, November 30, 1910, for session 1911. Scale 1:63,360 or 1 inch to 1 stat. mile. London: Edward Stanford, 1911. *Price* 2*s.*

Europe. **K. Preuss. Landesaufnahme.**

Uebersichtskarte von Mitteleuropa. Herausgegeben von der Kartogr. Abteilung der Kgl. Preuss. Landesaufnahme. Scale 1:300,000 or 1 inch to 4·7 stat. miles. Sheets: Kielce; Krakau; Tomaszów. Berlin: R. Eisenschmidt, 1910. *Price* 1.50*m. each sheet.*

Europe. **Schulze.**

Funkentelegraphenkarten. I. Westeuropa. Nach amtlichen Quellen und privaten Ermittlungen. [Von Kapitänleutnant E. E. Schulze.] Scale 1 : 5,000,000 or 1 inch to 78·9 stat. miles. *Petermanns Mitteilungen,* Jahrgang 1911, I., Tafel 10. Gotha: Justus Perthes, 1911. *Presented by the Publisher.*

France. **Ministre de l'Intérieur, Paris.**

Carte de la France dressée par ordre du Ministre de l'Intérieur. Scale 1:100,000 or 1 inch to 1·6 stat. mile. Sheets: iii.–14, Lesneven; ix.–12, Coutances; ix.–19, Ancenis; x.–14, Mortain; xi.–13, Falaise; xvi.–38, Ax-les-Thermes; xviii.–22, Moulins (Ouest); xxi.–22, St. Gengoux; xxv.–29, Briançon. Paris: Hachette & Cie., 1910. *Price* 0.80 *fr. each sheet.*

Germany. **K. Preuss. Landesaufnahme.**

Karte des Deutschen Reiches. Königreich Preussen. Herausgegeben von der Kartogr. Abteilung der Kgl. Preuss. Landesaufnahme. Scale 1:100,000 or 1 inch to 1·6 stat. mile. Kupferdruck-Ausgabe. Sheets: 27, Schwarzau; 463, Geisa; 509, Bad Orb; 523, Trier; 525, Simmern. Berlin: R. Eisenschmidt, 1909–1910. *Price* 1.50*m. each sheet.*

Switzerland. **Abteilung für Landestopographie, Bern.**

Topographische Karte der Schweiz. Scale 1:100,000 or 1 inch to 1·6 stat. mile. Sheets: 3, Liestal—Schaffhausen; 4, Frauenfeld—St. Gallen; 8, Aarau: Luzern —Zug: Zürich; 9, Pontarlier—Yverdon; 16, Genève—Lausanne; 17, Vevey—Sion. Beru: Abteilung für Landestopographie, 1909–10.

ASIA.

Central Asia. **Herrmann.**

Zentralasien zur Zeit der alten Handelsbeziehungen zwischen China und den iranisch-turanischen Ländern (114 v. Chr.—23 n. Chr. und 87–127 n. Chr.). Bearbeitet von A. Herrmann. Scale 1:5,000,000 or 1 inch to 78·9 stat. miles. *Petermanns Mitteilungen,* Jahrgang 1911, I., Tafel 4. Gotha: Justus Perthes, 1911. *Presented by the Publisher.*

Indian Government Surveys. **Surveyor-General of India.**

India and adjacent countries, scale 1 inch to 1 mile: Eastern Bengal and Assam,

5 sheets; Eastern Bengal and Assam and Bengal, 2 sheets; Bengal, 3 sheets; Bombay and Central India, 5 sheets; Burma, 9 sheets; Central Provinces, 3 sheets; Central Provinces, Madras, and Hyderabad, 1 sheet; Central India and Central Provinces, 2 sheets; Berar, 3 sheets; Madras, 1 sheet; Punjab, 1 sheet; Punjab, Baluchistan, and North-West Frontier Province, 1 sheet; North-West Frontier Province, 4 sheets; North-West Frontier Province, Punjab, Kashmir, and Jammu, 2 sheets; United Provinces, 5 sheets; United Provinces and Central India, 9 sheets. Calcutta: Survey of India, Map Record and Issue Office, 1910. *Presented by the Surveyor-General of India.*

Persia. **Strauss.**

Theodor Strauss' Reiserouten im westlichen Persien. Scale 1:600,000 or 1 inch to 9·5 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1911, I., Tafel 12. Gotha: Justus Perthes, 1911. *Presented by the Publisher.*

A supplementary map to those published in *Petermanns Mitteilungen* in 1905. It shows the recent routes of the German Vice-Consul Theodor Strauss, of Sultanabad, from that place to Senneh, Kirmanshah, and Kirind, on the scale of 1:600,000, with an inset of the neighbourhood of Kirmanshah on 1:300,000 and a general map of Persia as an index. The map accompanies an article, giving an account of this journey.

AFRICA.

Africa. **Geographical Section, General Staff.**

Map of Africa. Compiled in the Geographical Section, General Staff, War Office. Scale 1:125,000 or 1 inch to 1·9 stat. mile. Sheets: South A-27, V-ii., Mangea; South A-37, V-iv., Takaungu, East Africa Protectorate. London: E. Stanford; Sifton, Praed; T. Fisher Unwin, 1910. *Price 2s. net each. Presented by the Director of Military Operations.*

Belgian Congo. **Droogmans.**

Carte du Bas-Congo. Dressè par H. Droogmans. Scale 1:100,000 or 1 inch to 1·6 stat. miles. 15 sheets. Brussels: Falks Fils, 1910.

This is a new edition of a map published in 1901.

Egypt. **Survey Department, Giza.**

Topographical map of Egypt. Scale 1:10,000 or 6·3 inches to 1 stat. mile. Sheets: 15–6; 16–5; 17–2, 4; 26–1, 3, 4; 27–3, 4; 28–3, 4; 29–3. Giza: Survey Department, 1911. *Presented by the Director-General, Survey Department, Giza.*

German East Africa. **Gunzert.**

Skizze von Usukuma zwischen Muansa-Golf und Ssimiju-Flüss nach den Aufzeichnungen des Bezirksamtmanns Gunzert. Scale 1:150,000 or 1 inch to 2·3 stat. miles. Berlin: E. S. Mittler & Sohn, [1910]. *Presented by Dietrich Reimer's Geographical Establishment.*

A sketch-map of that part of German East Africa lying immediately south of Speke gulf and east of Smith sound, Victoria Nyanza. No latitudes or longitudes are given.

Italian Somaliland. **Istituto Geografico Militare, Florence.**

Carta dimostrativa della Somalia Italiana. Scale 1:200,000 or 1 inch to 3·2 stat. miles. Sheets: 1, Giumbo; 2, Gelib; 3, Pozzi di Macasi; 5, Passo di Comia; 6, Brava; 9, Merca; 10, Danane; 13, Barire; 14, Mogadiscio; 15, El Aracai; 19, Scidle; 20, Itala. Florence: Istituto Geografico Militare, 1910.

When complete this map will consist of forty sheets, each of which embraces 40 minutes of latitude and 1 degree of longitude. The whole area covered by the map extends in latitude from 0° 40′ S. to 5° 20′ N., and in longitude from 42° E. to 49° E. So far only twelve of the southern sheets in the neighbourhood of the coast from the Juba to the Webi Shebeli are published. These have been compiled from charts, route traverses, and other available information up to date, much of which is necessarily of an approximate nature.

AMERICA.

Bolivia. **Nordenskiöld.**

Ethnographische Karte von Ostbolivien. Entworfen von Erland Frhrn. v. Nordenskiöld. Scale 1: 4,000,000 or 1 inch to 63·1 stat. miles. *Petermanns*

Mitteilungen, Jahrgang 1911, I., Tafel 5. Gotha: Justus Perthes, 1911. *Presented by the Publisher.*

British Columbia. **Land and Works Dept., Victoria.**

Map of Yale district and portion of adjacent districts, British Columbia. Compiled and drawn in the Lands and Works Department, Victoria, B.C. Scale 1 : 506,880 or 1 inch to 8 stat. miles. Victoria: Lands and Works Department, 1910.

Chile. **Heuisler.**

Rejion Salitrera de Chile comprendida entre El Toco i Copiapó. Mapa construido en vista de recientes mensuras i completado con los trabajos topográficos de la Oficina de Limites por Jorje J. Heuisler. Scale 1 : 500,000 or 1 inch to 7·8 stat. miles. 4 sheets. [Santiago], 1907. *Presented by Sr. Jorje J. Heuisler.*

A map of the nitrite region of Northern Chile, with a list of the various nitrite companies whose properties it includes, with statistics of the amount of production and other information connected with each. The map has been prepared by Mr. J. J. Heuisler, the Government Inspector of the new Arica-La Paz railway, and forms what is doubtless the best general map of the region up to the date of its publication, special attention having been given to the development of railways and roads, as well as to the topographical features. Mr. Heuisler is at present preparing another map to serve as a continuation of this one to the north, which will include the country between Arica and Copiapó.

North America. **Schulze.**

Funkentelegraphenkarten. II. Nordamerika. Nach amtlichen Quellen und privaten Ermittlungen. [Von Kapitänleutnant E. E. Schulze.] Scale 1 : 12,500,000 or 1 inch to 197·3 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1911, I., Tafel 20. Gotha: Justus Perthes, 1911. *Presented by the Publisher.*

United States. **Rand, McNally & Co.**

Rand, McNally's Indexed Pocket maps: Florida, scale 1 : 1,203,840 or 1 inch to 19 stat. miles; Idaho, scale 1 : 1,647,360 or 1 inch to 26 stat. miles. Chicago and New York: Rand, McNally & Co., 1910.

PACIFIC ISLANDS.

Bismarck Archipelago. **Sapper.**

Höhenschichtenkarte von Neu-Hannover. Scale 1 : 100,000 or 1 inch to 1·6 stat. miles.—Höhenschichtenkarte von Neu-Mecklenburg. Scale 1 : 200,000 or 1 inch to 3·2 stat. miles. 2 sheets. Nach eigenen und fremden Aufnahmen entworfen von Dr. Karl Sapper. *Mitteilungen aus den deutschen Schutzgebieten*, Ergänzungsheft No. 3, 1910, Karten 1, 2, 3. Berlin: E. S. Mittler & Sohn, 1910. *Presented by Dietrich Reimer's Geographical Establishment.*

These three sheets show clearly the general relief of the islands, so far as it is known at present, by approximate contours and colour tinting in brown, from Dr. Karl Sapper's own surveys, combined with other information. On each sheet a sketch-map of the geology of the same island is given as an inset.

Bismarck Archipelago—Anir Islands. **Sapper.**

Ausflüge auf Anir (Feni) und Lir entworfen von Dr. Karl Sapper. Scales 1 : 50,000 or 1·3 inch to 1 stat. mile, and 1 : 150,000 or 1 inch to 2·4 stat. miles. *Mitteilungen aus den deutschen Schutzgebieten*, Ergänzungsheft No. 3, 1910, Karte 5. Berlin: E. S. Mittler & Sohn, 1910. *Presented by Dietrich Reimer's Geographical Establishment.*

Bismarck Archipelago—Neu-Mecklenburg. **Sapper.**

Uebersichtskarte von Neu-Mecklenburg und den Nachbargebieten zur Veranschaulichung der Lage der bekannt gewordenen Terrassen entworfen von Dr. Karl Sapper. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. Die Verbreitung der Vegetationsformationen auf Neu-Mecklenburg und den Nachbargebieten. Nach eigenen Aufnahmen nach Aufnahmen von Dr. G. Frederici u. Angaben von Herrn Boluminski u. der deutschen Seekarte entworfen von Dr. Karl Sapper. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. Uebersichtskarte der Ungeführen Volksdichte auf Neu-Mecklenburg und den Nachbargebieten entworfen von Dr. Karl Sapper. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. *Mitteilungen aus den deutschen Schutzgebeiten*, Ergänzungscheft, No. 3, 1910. Karten 6, 7, 8. Berlin: E. S. Mittler & Sohn, 1910. *Presented by Dietrich Reimer's Geographical Establishment.*

Three outline maps covering the same area and on the same scale, showing as far

as is possible from the information available, by shading and symbols in black lines, the height of land, character of vegetation, and density of population.

Solomon Islands. **Sapper.**

Aufnahmen auf Bougainville 1908. Von Dr. Karl Sapper. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. *Mitteilungen aus den deutschen Schutzgbieten*, Band xxiii., 1910, Karte 5. Berlin: E.S.Mittler & Sohn, 1910. *Presented by Dietrich Reimer's Geographical Establishment.*

Dr. Karl Sapper's explorations in Bougainville extend from Kiëta on the east coast, across the island to Kaiserin Augusta bay on the west, and along the south-east coast south of Kiëta. Numerous heights and geological notes are given along the routes, while at the bottom of the map appears a vertical section.

The map of the island of Buka, which lies immediately to the north of Bougainville, has been drawn, as regards coast-line, from the German Admiralty Chart No. 100, supplemented in the south by the surveys of Captain Voogdt, while the little topography of the interior that is shown is from the surveys of Dr. Karl Sapper (1908) and Dr. G. Friederici (1909). One map of the island shows routes, and the other a sketch of the geology in black symbols.

GENERAL.

World. **Philip.**

Philip's Visual Series of Improved Contour Outline Maps: Europe; England and Wales; North London; South London; Scotland; Ireland; France; Germany; Basins of Rhine, Danube, and Po; Asia; Africa; North America; United States; South America. London: George Philip & Son, Ltd., [1911]. *Single Maps*, 1*d.* *each.* *Presented by the Publishers.*

A series of outline maps in black, with contour lines only, for use in schools. The contours shown on the maps of continents and countries are the 600, 1200, and 3000 feet, and on the district maps 200, 400, and 600 feet. There is certain novelty in the method of showing the contour lines, inasmuch as they increase in intensity with the height of the land above sea-level, the object being in this manner to give an impression of relief. The maps are printed on strong paper, so that the student can colour the contours, or between them, on the layer system, mark distributions of natural phenomena, show routes, etc., as may be desired.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during January, 1911. *Presented by the Hydrographer, Admiralty.*

New Charts—No. 9, England, east coast, river Stour: Harwich to Harkstead point, 2*s.* 3757, Borneo, west coast: Tanjong Sambar to Tanjong Beras Basah, 4*s.* **New Editions**—Index charts A to V. No. 2159, Scotland, west coast: Firth of Clyde and Loch Fyne, 4*s.* 2501, Scotland, west coast: Loch Inver to Loch Broom, 3*s.* 1491, England, east coast: Harwich harbour, 3*s.* 120, Netherlands: River Schelde, from the sea to Antwerp, 5*s.* 3158, The Skagerrak: Nevlunghavn to Torbiörnskier, 4*s.* 3159, The Skagerrak: Torbiörnskier to Jaelön, 4*s.* 2115, The Kattegat: The Sound, 3*s.* 2263, Baltic sea: Gulf of Riga entrance, 3*s.* 243, Africa, north coast: Port of Alexandria, 3*s.* 3119, Africa, north coast: Alexandria harbour, 3*s.* 252, Africa, north coast: Cape Bougaroni to Fratelli rocks, 3*s.* 3177, South Polar chart showing tracks and discoveries, 3*s.* 2177, America, north coast: Baffin bay, 2*s.* 1132, Gulf of St. Lawrence: Mingan islands, eastern sheet, 2*s.* 2526, South America, east coast: Buenos Aires road, 3*s.* 1421, Africa, east coast: River Chinde, 1*s.* 2837*a*, Persian gulf: Eastern sheet, 3*s.* 753, Entrance to the Persian gulf, 3*s.* 2112, Borneo: Ambong bay to Sampanmangio point, 3*s.* 287, Borneo: Gaya bay to Sandakan harbour, 3*s.* 2195, Sketch plans of anchorages in the eastern part of Celebes, 2*s.* 967, Philippine islands: Palâwan island, 3*s.* 2577, Philippine islands: Between St. Bernardino and Mindoro straits, 3*s.* 2660*b*, China sea, southern portion, 3*s.* 1752, Australia, south coast: Approaches to Port Adelaide, 2*s.* 2685, New Zealand: Cook strait anchorages, Sheet II., 3*s.* 982, Caroline islands: Truk or Hogolu islands, 3*s.*

Atlantic, North. **U.S. Hydrographic Office.**

Pilot chart of the North Atlantic Ocean, February, 1911. Washington: U.S. Hydrographic Office, 1911. *Presented by the U.S. Hydrographic Office.*

Atlantic, North, and Mediterranean. **Meteorological Office.**

Monthly meteorological charts of the North Atlantic and Mediterranean, March, 1911. London: Meteorological Office, 1911. *Price 6d. each. Presented by the Publishers.*

Indian Ocean. **Meteorological Office.**

Monthly meteorological charts of the Indian Ocean, March, 1911. London: Meteorological Office, 1911. *Price 6d. each. Presented by the Meteorological Office.*

Indian Ocean. **U.S. Hydrographic Office.**

Pilot chart of the Indian Ocean, April, 1911. Washington: U.S. Hydrographic Office, 1911. *Presented by the U.S. Hydrographic Office.*

Pacific. **U.S. Hydrographic Office.**

Pilot chart of the North Pacific Ocean, March and April, 1911. Pilot chart of the South Pacific Ocean, March, April, and May, 1911. Washington: U.S. Hydrographic Office, 1911. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Bolivia and Peru. **Fawcett.**

Eighty-seven photographs of Bolivia and Peru, taken by Major P. H. Fawcett, R.A. *Presented by Major P. H. Fawcett, R.A.*

These photographs were taken during Major Fawcett's latest expedition in connection with the boundary between Bolivia and Peru, during which the river Heath was ascended for the first time. An account of this expedition is given in the present number of the *Geographical Journal*.

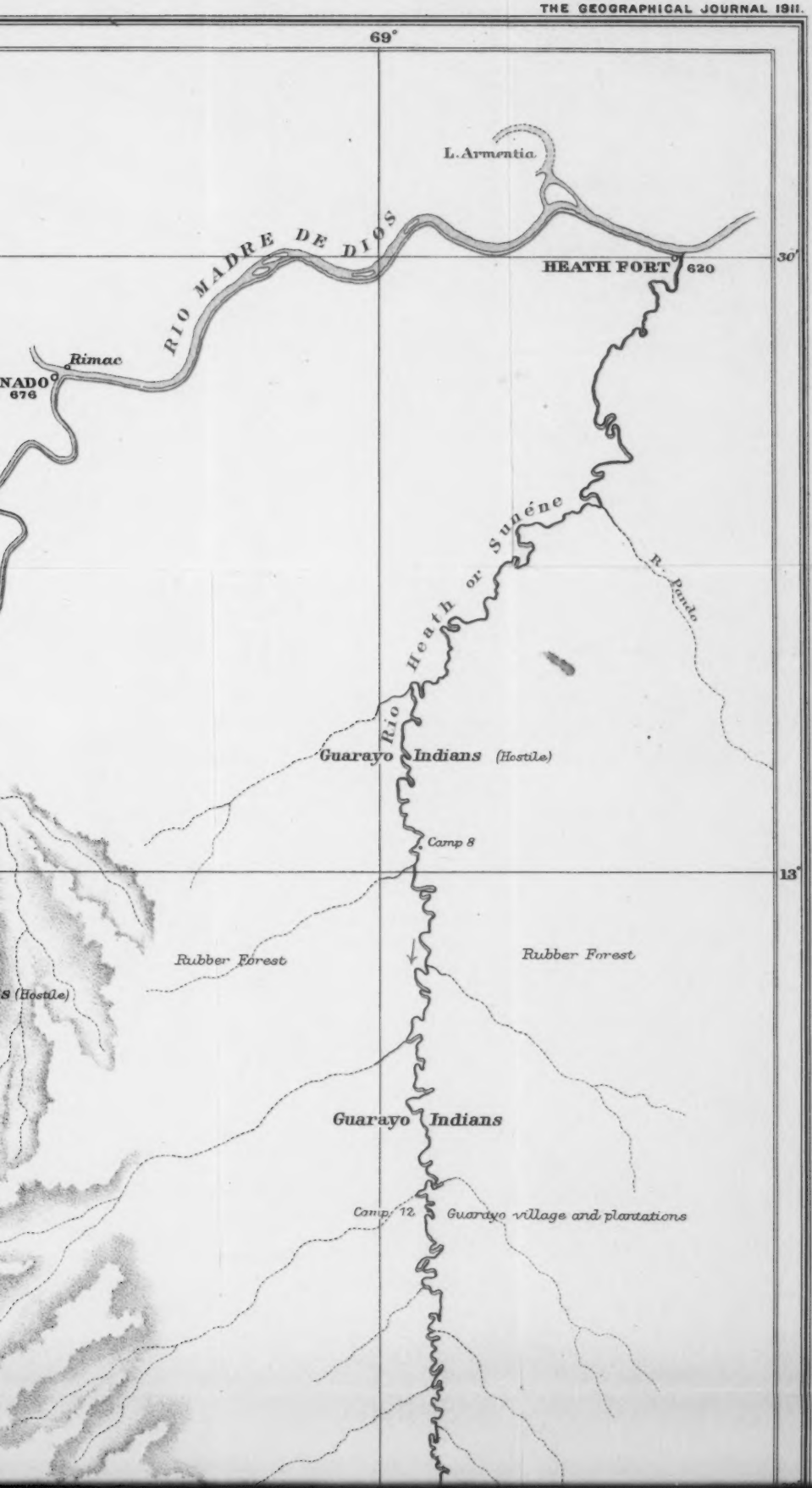
(1–3) On the Inca Mining Company's road; (4–7) On the Inca Mining Company's trail; (8) Camp on the Inca Mining Company's road; (9 and 10) Bridges on the Inca Mining Company's trail; (11 and 12) The Altiplanicie, Peru; (13) Road on the Altiplanicie; (14) Alpacas on the Altiplanicie; (15) Indians of the Altiplanicie sorting potatoes; (16) Crucero; (17–20) Aricoma pass; (21 and 22) Aricoma lake; (23 and 24) Sto. Domingo gold-mine; (25–28) Astillero; (29) "Caneru," cut out of a man at Astillero; (30) Crossing the river near Astillero; (31 and 32) Pto. Maldonado; (33) Administration building, Pto. Maldonado; (34) Leigh and Costin, making fans for flies, Pto. Maldonado; (35) Confluence of the Heath and Madre de Dios; (36 and 37) Bolivian force at mouth of Heath; (38 and 39) Station at mouth of the Heath; (40) Lower Heath; (41) Ascending the Heath; (42) Method of slinging hammocks, lower Heath; (43–46) Middle Heath; (47) Camp, middle Heath; (48) Snags, Middle Heath; (49) Middle Heath, showing high-water level; (50) Middle Heath; (51) Locality of attack by Guarayos, Heath; (52 and 53) Guarayos; (54) Major Fawcett and Guarayo Indians; (55 and 56) Huts of the savages, Heath; (57–68) The upper Heath; (69) An Echoja of the Heath; (70–73) Camps on the upper Heath; (74) Balsas of the Echojas, upper Heath; (75) Echojas, upper Heath; (76) Captain V. Bozo, upper Heath; (77 and 78) Rapids, upper Heath; (79) Rocks in upper Heath; (80) Ablutions, upper Heath; (81) Ascent of upper Heath; (82) In the upper Heath; (83) Echojas of the Tambopata; (84) Rio Lanza; (85) Confluence of the Lanza and upper Tambopata; (86) Path in forest at S. Carlos; (87) Leigh and balsa, upper Tambopata.

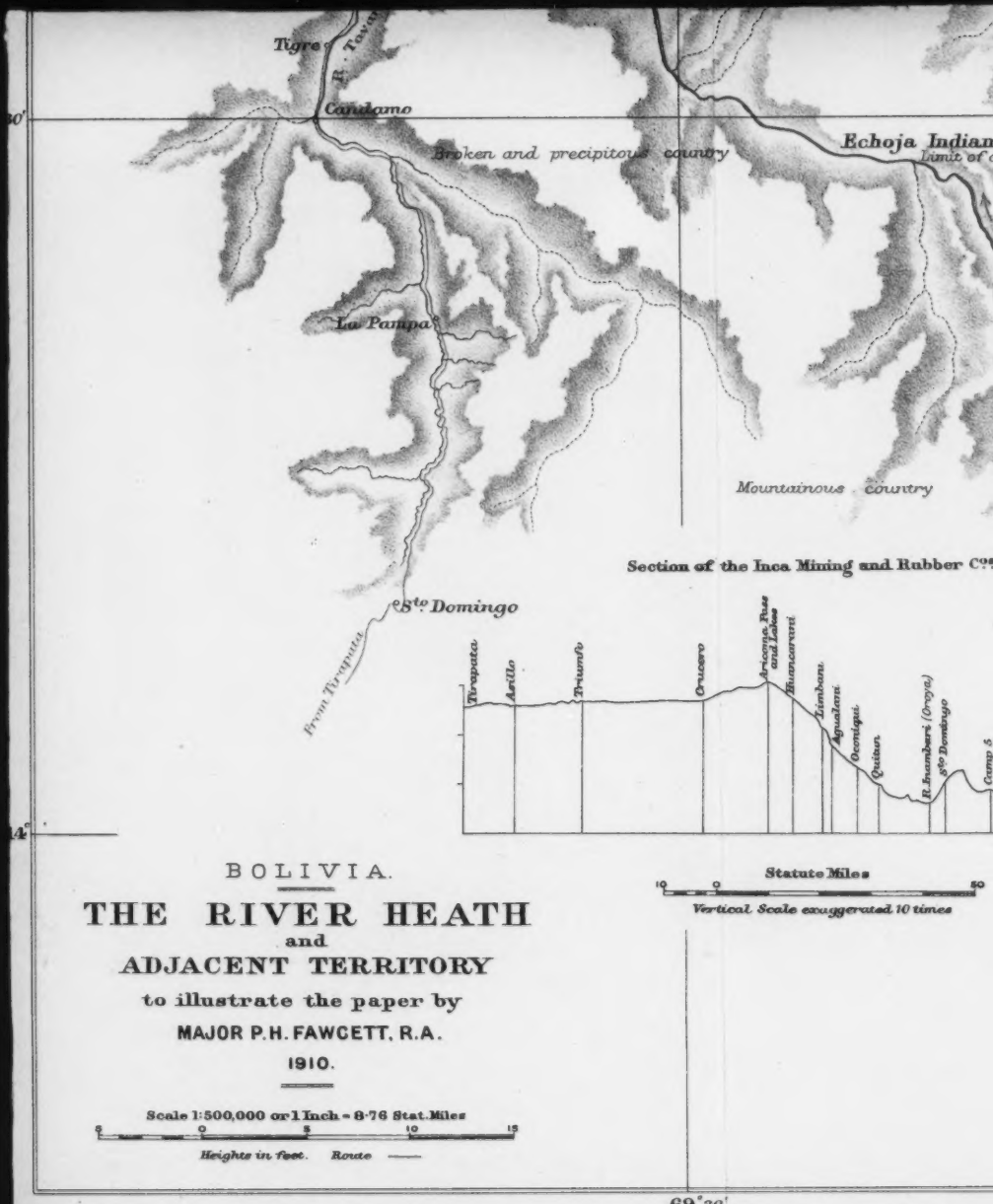
German Colonies. **Schwabe.**

Die Deutschen Kolonien. Herausgegeben von Major A. D. Kurd Schwabe. Band II. Deutsch-Ostafrika—Kaiser Wilhelmsland und die Inselwelt im Stillen Ozean—Samoa—Kiautschou. Mit 125 Farbenphotographen nach der Natur und Zwar, 20 Tafelbilden und 105 Bildern im Text. Berlin: Weller & Hüttich, 1911.

N.B. It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

Scale 15,000,000 or 1 Inch = 87·6 Stat. Miles
Riberalta
R. Beni
Rio Madre de Dios
Heath Pt
Pto Maldonado
R. Manuripi
R. Madidi
R. Orthon
R. Tahuamanu
Antillero
Cavinas
La Rompe
Puerto
Sto Domingo
B O L I V I A
Reyes
Loreto
Exaltacion
L. Reyesuna
Plains of Mojos
Tumupasa
San José
R. Tuichi
Rurenabaque
Lambaré
Mapiri
Caupolican
Ixiamas
Apolo
Pelechuco
Apollo
Tarapaya
R. Pelco
Lake 12509 Ft Titicaca
Illampu 21276 Ft
Puno
Juli
LA PAZ
Pto MALDONADO 676
Baltimore
Limit of launch navigation
R. Malinuski
R. Tamboparia
Chunchu Indians (Hosta
Broken and precipitous country
R. Pavo
ASTILLERO 850
Tigre
R. Tavara
Cavinas


69°
L. Armentia
RIO MADRE DE DIOS
HEATH FORT
620
30°
Rimac
NADO
676
Rio Heath or Sunéne
R. Pando
Guarayo Indians (Hostile)
Camp 8
13°
Rubber Forest
Rubber Forest
S (Hostile)
Guarayo Indians
Camp 12
Guarayo village and plantations



BOLIVIA.

THE RIVER HEATH
and
ADJACENT TERRITORY

to illustrate the paper by

MAJOR P.H. FAWCETT, R.A.

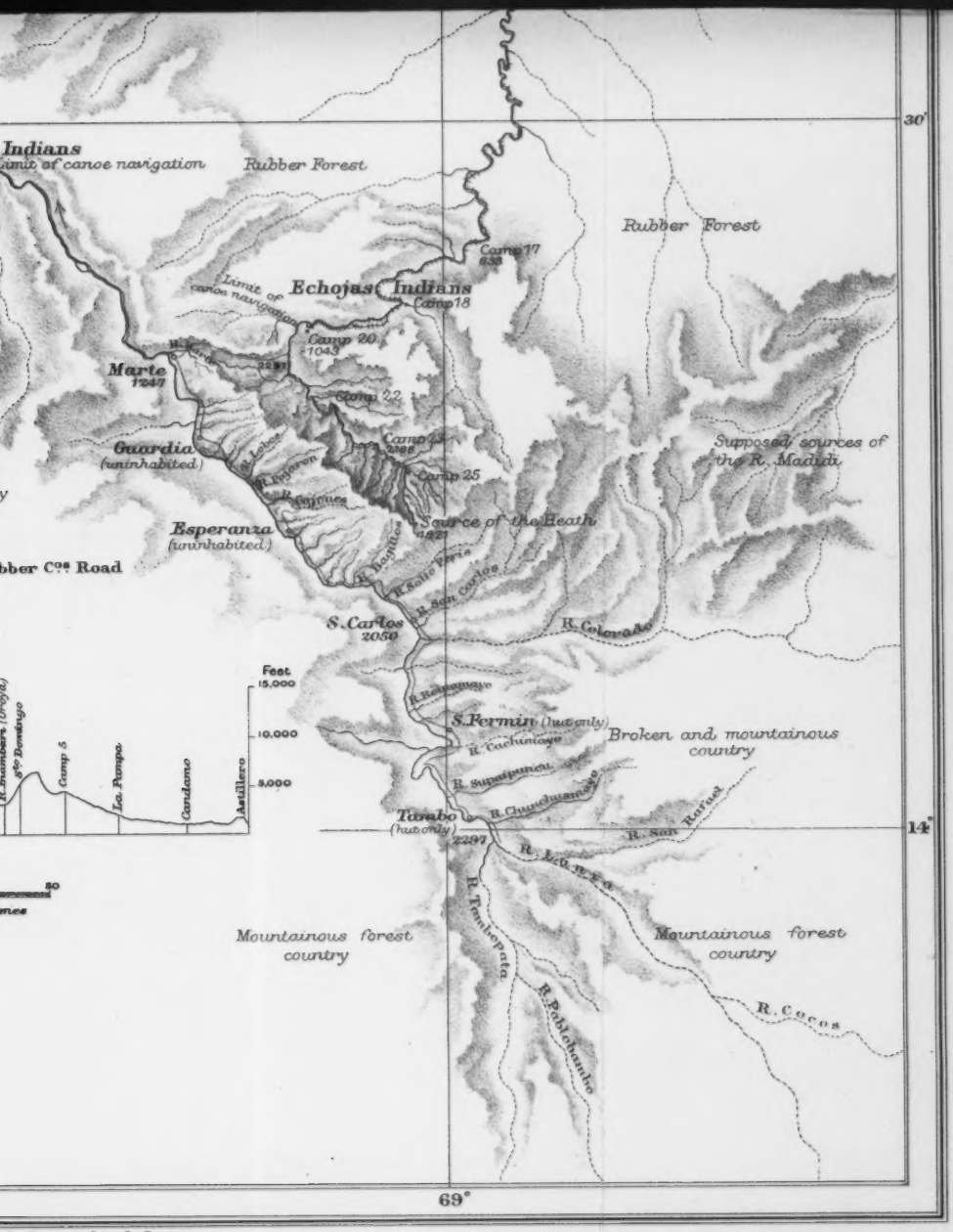
1910.

Scale 1:500,000 or 1 Inch = 8·76 Stat. Miles

0 0 5 10 15

Heights in feet. *Route* ——

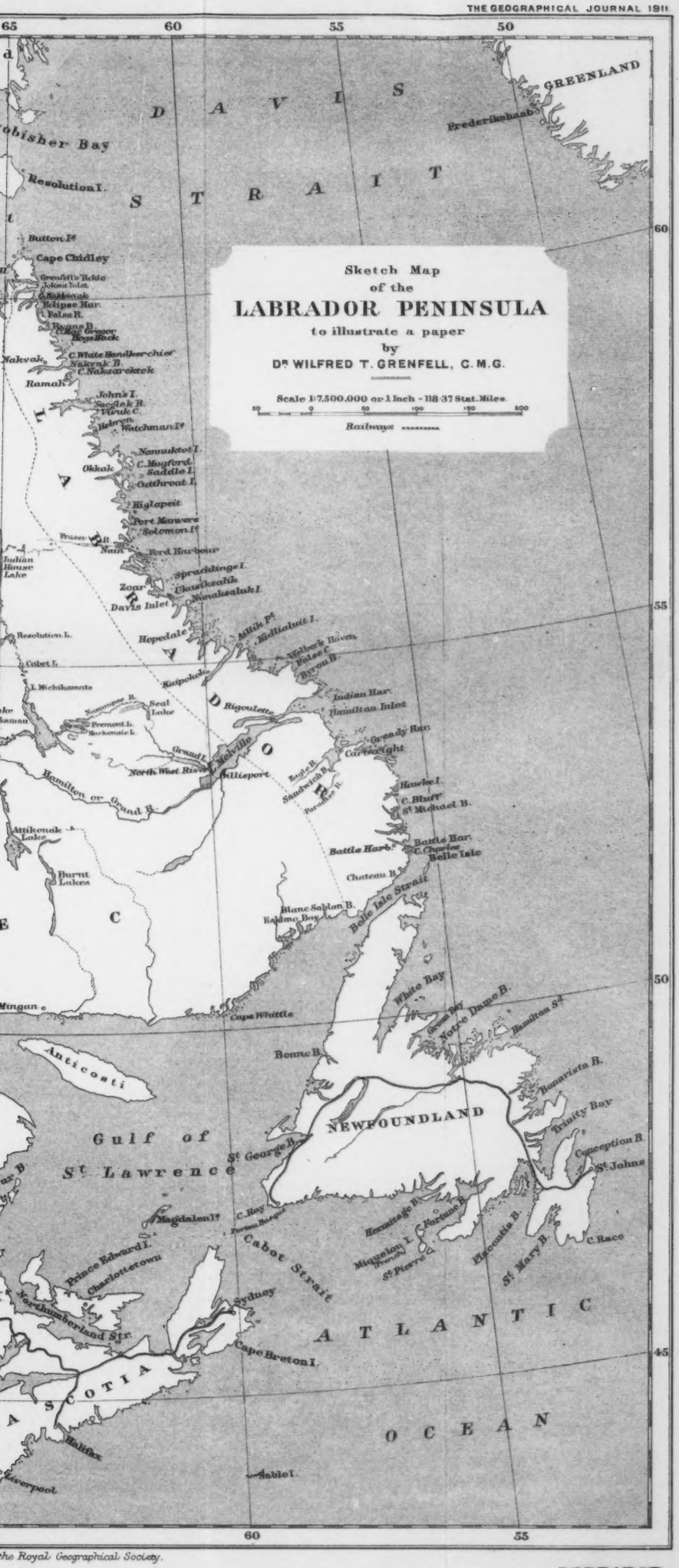
Published by the Royal Geogr



al Geographical Society.

RIVER HEATH
Fawcett.

Published by the Royal



the Royal Geographical Society.

LABRADOR
Grenfell.

ROYAL GEOGRAPHICAL SOCIETY.

ANNUAL DINNER.

The Annual Dinner this year will be held

On FRIDAY, MAY 26

(and **NOT** on the day of the Annual Meeting), in the Great Hall of the Hotel Cecil, when the newly-elected President will take the Chair. This being the Coronation year, it is hoped that the occasion may be marked by several distinctive features. As the attendance is likely to be exceptionally large, and the number of places is limited, Fellows are requested to make early applications for tickets to the Chief Clerk, 1, Savile Row, W. After May 11 places will be first allotted to all Fellows who have applied, and then to their Guests, if accommodation be available.

Lord Curzon of Kedleston will be nominated by the Council for election to the Presidency at the Annual Meeting on May 22.

D. A. Johnston, C. F. Close, *Hon. Secretaries.*
J. S. Keltie, *Secretary.*

1, Savile Row, W.,
March 28, 1911.

CAPTAIN COOK MEMORIAL.

A VERY representative and influential Committee, of which His Majesty the King, when Prince of Wales, graciously acted as Honorary Chairman, has been formed, under the auspices of the British Empire League, to carry out the proposal made by Sir Joseph Carruthers, K.C.M.G., ex-Premier of New South Wales, that a monument should be erected in London to the memory of Captain Cook. It is felt to be wrong that Australians and New Zealanders, visiting the Capital of the Empire, should find there no memorial to the memory of a man whose intrepid explorations resulted in such notable additions to the British dominions, and whose scientific work has been of the greatest value to mankind.

The Committee propose that a memorial, by a sculptor of repute, should be erected in the best available position in the centre of London. The First Commissioner of Works has promised his co-operation in the choice of a suitable site. For the purpose of a fund at least £3000 will be needed, to which the Committee now invite contributions. Nearly one-third of that amount has been subscribed by the members of the Committee.

Should there be any unexpended balance after defraying the cost of the memorial, it is intended to employ it in the erection of tablets in the village of Martin-in-Cleveland, Yorkshire, where Cook was born; in Great Ayton in the same district, where he was educated in a school building which still stands; and in Whitby, with which he was closely connected for many years.

The Council of the Society recommend the Captain Cook Memorial to the favourable consideration of the Fellows of the Society. Cheques should be crossed "Robarts, Lubbock & Co.," and made payable to the Treasurer, The Lord Brassey, G.C.B., 24, Park Lane, London, W.

1, SAVILE ROW, W.,
March 23, 1911.